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VOL.26 NO. 5

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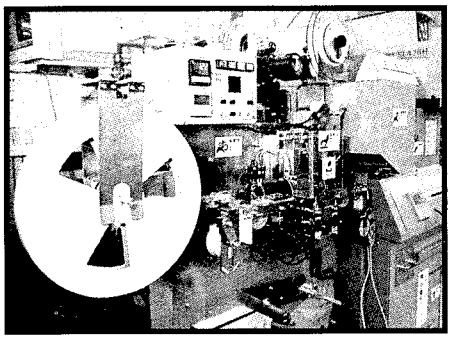

Publisher:
Japan External Trade Organization,
Industry and Technology Dept.
2-2-5, Toranomon, Minato-ku, Tokyo 105-8466, Japan
Tel: +81-3-3582-4631 Cables: JAPANETRO TOKYO
Telex: J24378 Fax: +81-3-3582-7508

Editor:
Three "I" Publications, Ltd.
2-2-5, Uchikanda, Chiyoda-ku, Tokyo 101-0047, Japan
Tel: +81-3-3256-3100 Fax: +81-3-3256-3170

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Cover Photo: *Electronics Manufacturing Plant Developing Production Technology for Transplant Factories -Shiroishi Plant of Tokin Corp.-*

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KEIRIN 00 本印刷物は，日本自転車振興会から，競輪収益の一部である機械工業振興資金の援助を受けて作成したものである。

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INNOVATIVE PRODUCTION NOW

This section describes a specialized section or whole process of a representative factory which excels in specific aspects of production.

Electronics Manufacturing Plant Developing Production Technology for Transplant Factories
– Shiroishi Plant of Tokin Corp. –

Introduction

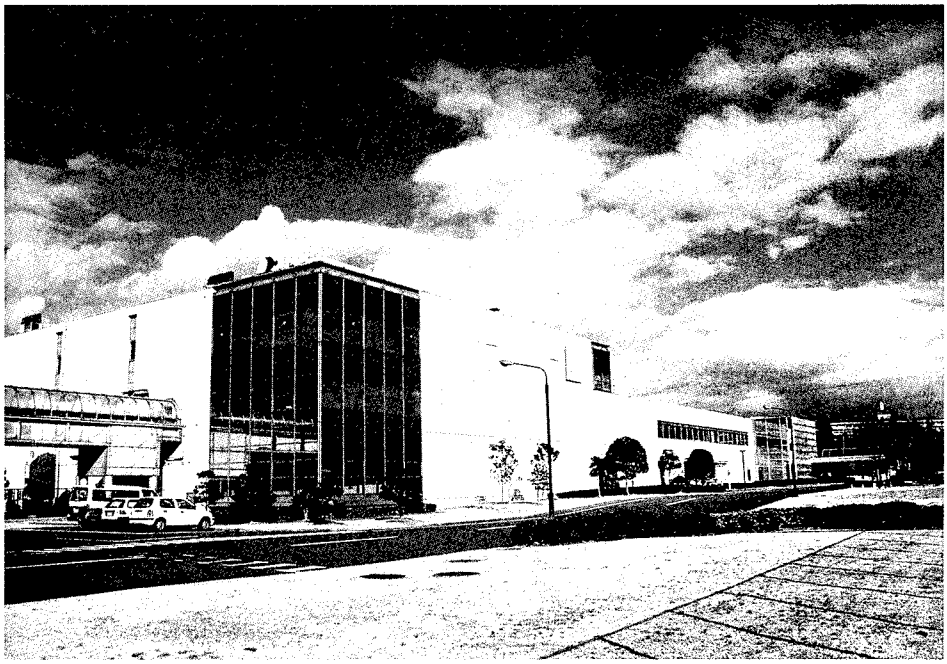
Many Japanese electronic products manufacturers are involved in worldwide operations to distribute their products quickly to clients by establishing transplant bases and distribution centers in the important locations worldwide.

Therefore, the production capabilities and the role of the domestic production plants has steadily changed in recent years.

There are two types of production transfer; firstly transfer of production works to their subsidiaries or consigned but including production technology transfer in Japan, and secondary transplant movement. These trends can to seen both in giant manufacturers and mid-scale manufacturers. However, generally speaking, high-tech products including from materials to intermediate, and finished products are produced in the company plants, and mass production products mainly consists of assembly works transferred to foreign countries or transplants worldwide.

Accordingly, the electronics companies are now establishing new strategies for production of how to use the marginal production capacity of domestic plant created by production consignment or transplant operation.

This issue introduces the Shiroishi Plant of Tokin Corporation which is good example when considering how to effective management of marginal production capacity, plant resources, etc.



Front view of Shiroishi Plant of Tokin Corp.

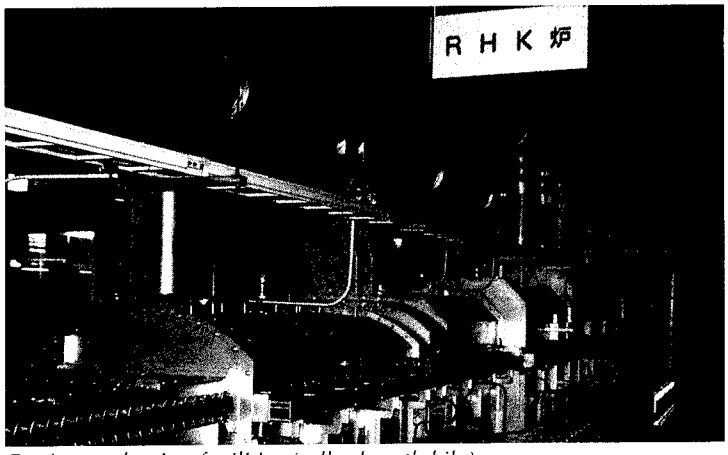
1. Outline of Tokin Corp.

Tokin Corp. was established in 1938 as the Nippon Tokushu Kinzoku, Ltd. for production of magnetic materials for use in communications equipment by the Ministry of Communications (present NTT Corp.), with merger of the Tohoku Metal Industries Co., Ltd. established in 1934 for commercialization of research results by Tohoku University, and changed the name to Tohoku Metal Industries, Ltd., and in 1988 the company has changed its name to the present Tokin Corporation at the memorandum year of the 50th anniversary.

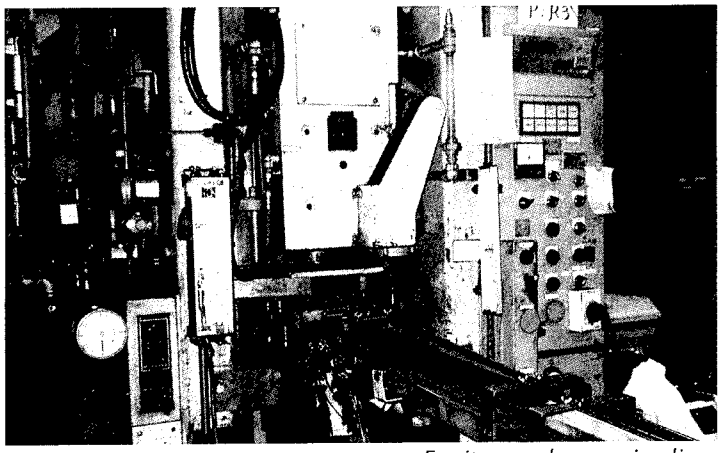
Today, Tokin has 5 domestic production plants , and two transplants in China for production of ferrite cores, and Vietnam for coils and transformer productions. The present production share of total production by transplants is about 20%, and it will be expanded to about 40% in year 2000.

So, the present Tokin Corp. has succession of two former company's characteristics that are two directions of establishing mass production technologies and R&D-oriented activities.

The company today produces and market various types of products from metal and magnet, electronic devices, ferrites, ferrite devices, electronic-applied products (various types of magnetic & IC cards, telephone card, etc.), major electronic components and devices (AV devices, OA equipment, communications equipment, telephone cards, car-electronics, auto-



Ferrite production facilities (roller hearth kiln)


Ferrite powder pressing lines

matic ticket checker, etc.

Recently, the company has announced the start of semiconductor (MOS IC) production in the near future, and plans to a construct new plant at the Shiroishi Plant.

3. Shiroishi Plant

(1) Site, Plant Area & Staff

The Shiroishi Plant was constructed in April 1985 for its key production bases at the Asahi-machi, Shiroishi City, Miyagi Pref. on a site area of 91,000 m^2, and has building areas of 49,800 m^2. It takes about two hours from Tokyo to Shiroishizao Station by Tohoku Shinkansen, and 5 minutes by taxi. The plant site has good traffic accesses such as about 20 minutes from the Shiroishi Interchange in Tohoku Expressway, and about 50 minutes from the Sendai Airport by car including the Tohoku Shinkansen mentioned above.

The total of workers in the plant are 690 which is more than one-third of company's total employees.

(2) Products

The Shiroishi Plant has started to produce mass production products, but the evolvement of transplant operation, the role of the Shiroishi Plant is changed to the production of newly developed products and high-tech products, and to develop or establish advanced and cost effective production technologies for transplants.

At present, broadly classified products produced in the plant are ferrites & ferrite cores, semiconductors (MOS IC), SMD (surface mount devices), and various types of cards such as telephone and other cards. Especially, the card production is rapidly growing, but is opened to view for only limited staffs in the company, and not opened to the public according to the requirements of clients.

Accordingly, this issue introduces the ferrite, semiconductors, SMD, and optic devices manufacturing lines.

(3) Production Lines

1) Ferrite Line

Ferrite and ferrite products are long selling products for the company, and now produced only at this line. Coarse ferrite powder is produced using quality manganese materials available only in Japan with the world's largest ferrite powder production plant. Production capacity is about 300 tons of ferrites per month, and about a half of products are consumed in the plant, and the remainder are supplied to its transplant or outside clients.

Ferrite powders produced by the rotary kiln and ground by mills are transferred to ferrite lines for pressing ferrite cores which consists of 15 units of presses with capacity ranging 60 tons and 10 tons.

The plant produces more than 9,000 to 10,000 types of ferrite cores classified by size, composition ,electric characteristics, and uses, so various types of molds are prepared. Molded ferrite core was sintered or fired by three long kilns fired by electric heat and gas fired, and one roller hearth kiln.

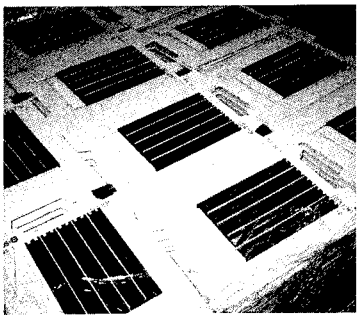
The kiln firing hours are 20 hours from charging the green ferrite and discharged sintered ferrite, and about 8 hours by gas fired kiln.

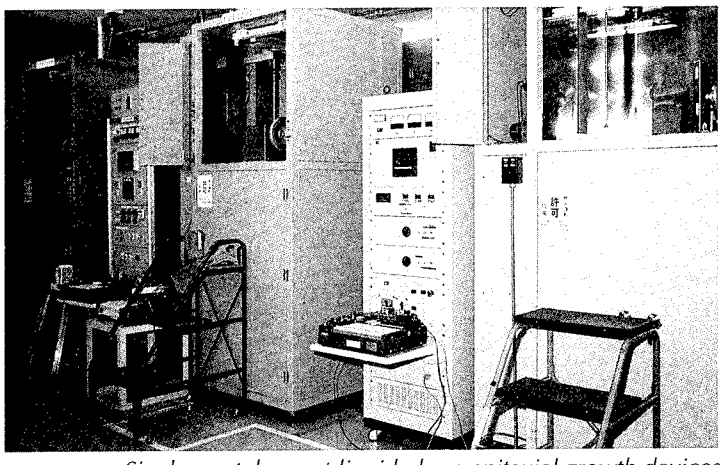
Production of ferrite cores are based on the orders, and 24-hour operation systems.

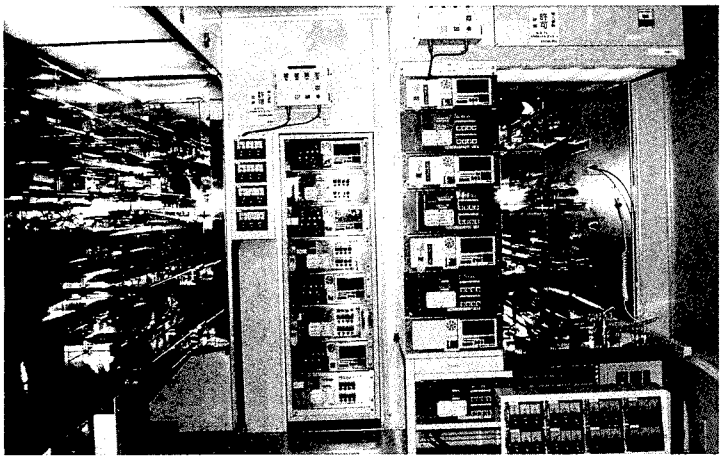
Sintered ferrite cores are next transferred to grinding and machining for final finish processing where 6 lines are installed.

This line for ferrite powder to ferrite cores production use established advanced production technology and know-how, and is conducting the development of more ef-

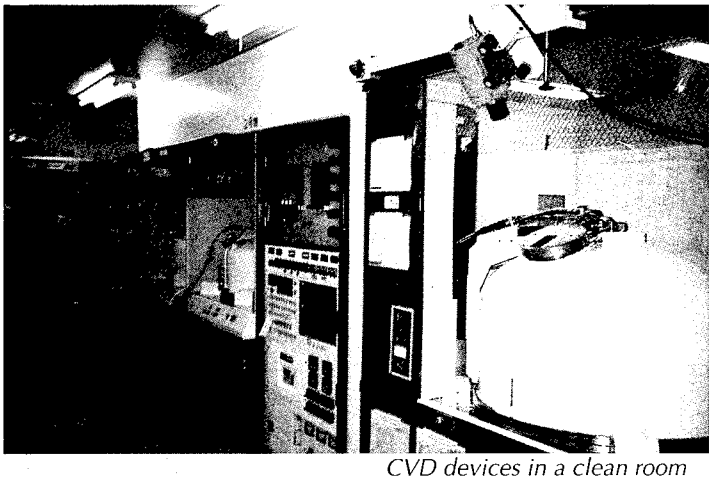

Ferrite powder production


Ferrite cores for shipment


Single crystal garnet liquid phase epitaxial growth devices



Thermal diffusion furnace in a clean room



CVD devices in a clean room

fective production methods in parallel with the actual production for technology transfer to transplant.

2) Semiconductor Line (IC)

This line consists of various levels of clean rooms, but is a test production scale for semiconductors especially MOS IC. At present facilities, this line can produce 4 and 5 inches size wafer. This line was constructed for establishing the most rationalized and high cost/performance production technologies and facilities surpassed with existing levels in the world, and train the engineers, technicians and workers.

Therefore, it is small lot production at present, but the major aim is the development of production technologies without installation of expensive production facilities. So, there are various ideal systems or know how applied for maintaining and boosting clean conditions such as the control of air flow rates and directions. As the unique technology, the wafer is transferred with a linear motion system which enables no damage transfer of wafers quickly.

Installed major production facilities are LPCVD (Low Pressure Chemical Vapor Deposition) devices, PR (photoresists) devices, steppers, ion implanting devices, washing devices, etc. for conducting 250 to 300 process steps to produce semiconductors.

This line is leaded by engineers well experienced in both production technology of quality semiconductors and engineering and construction of cost effective production lines.

By the establishment of cost effective and high productivity semiconductor manufacturing technology and facilities, the company plans to construct the commercial scale semiconductor manufacturing plant on the plant site in the near future.

This line will become not only the plant major line but also the major product in the company.

3) Optical Devices Line

In this line, optic communications components and parts are produced from single crystal garnet as raw materials to finished products as optical isolators, optical isolators for visible rays and near infrared rays, optical electric field sensors, optical circulators, electro-optic sensors for remote antenna systems, cellular phone, etc.

Single crystal garnet is produced by using the liquid phase epitaxial growth process using seed garnets. This line has installed 7 units of the garnet film devices, which is the largest number in Japan. Next, the single crystal garnet is cut thick and large wafer size, and inspected and polished by the grinders, and the characteristics and performance tests performed , and finally assembled as finished products as mentioned above.

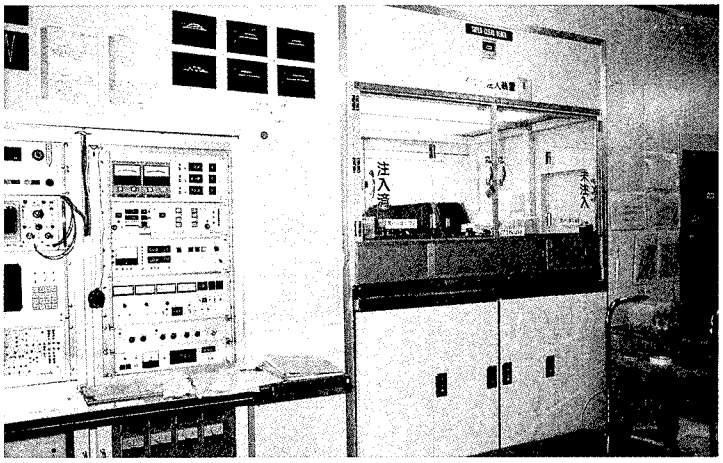
The production quantity is for company consumption only.

4) SMD Line

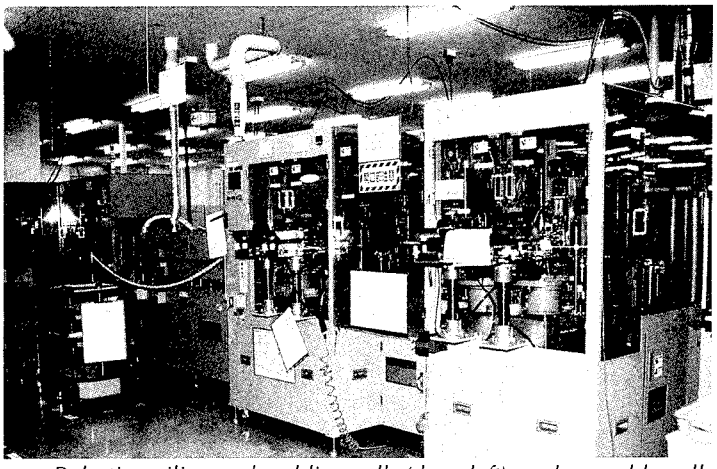
At visit day, the surface mount P-type lead-wire less power inductors were produced in this line. The line consists of two production lines with robotic and automated production cells such as coiling and welding cells, assembly cells, molding cells, and each cell is connected by belt conveyors. The high speed production technologies with in-line inspection and SMD packaging are already established.

Semiconductor cleaning equipment in a clean room

Photoresist devices in the highest level clean room



Ion implanters in a clean room



Robotic coiling and welding cells (deep left), and assembly cells (right two cells) for lead-wire less power inductors

The final inspection and performance checking is also made for finished products packaged in tapes as SMD by high speed electronic checkers. These robotic production cells, and inspection and checking devices has also developed its own.

However, the production capacity of the SMD line at present is mid-scale as the major part of production has already been transferred to its overseas plants.

So, it can be said that the role of the SMD line has changed to the development of production technology and know-how through actual production, and the successful results of the development are transferred or will be transferred to the company's transplant in China and Vietnam at present, and other countries in the near future.

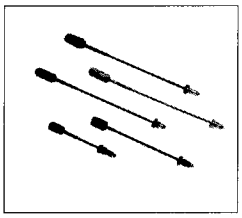
4. Plant Management

Plant management of the Shiroishi Plant is well maintained for both production levels, and the quality assurance systems from raw materials to finished products.

The cleanness of the plant is also carefully maintained.

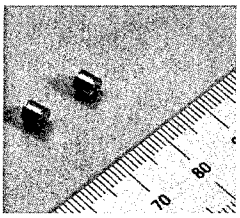
5. Recent Product Topics

(1) Cellular Phone Antenna

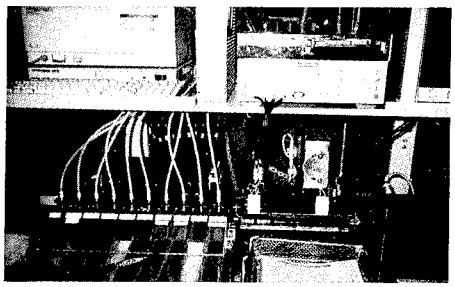


Using super-elastic memory alloy, these antennas are highly resistant to bends or breakage, making possible the light-weight design of the cellular phones.

(2) Optical Isolators

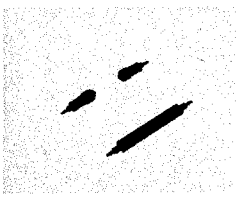


This is indispensable for optical communications, and a key device in multimedia age. Tokin is the world's first company to commercialize isolators for use in the 0.98, 131, 155 and more micron wave length.



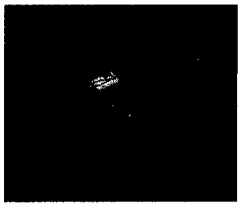
Performance testing & checking devices of power inductors

(3) Optical Electric Field Sensor and Antenna Units

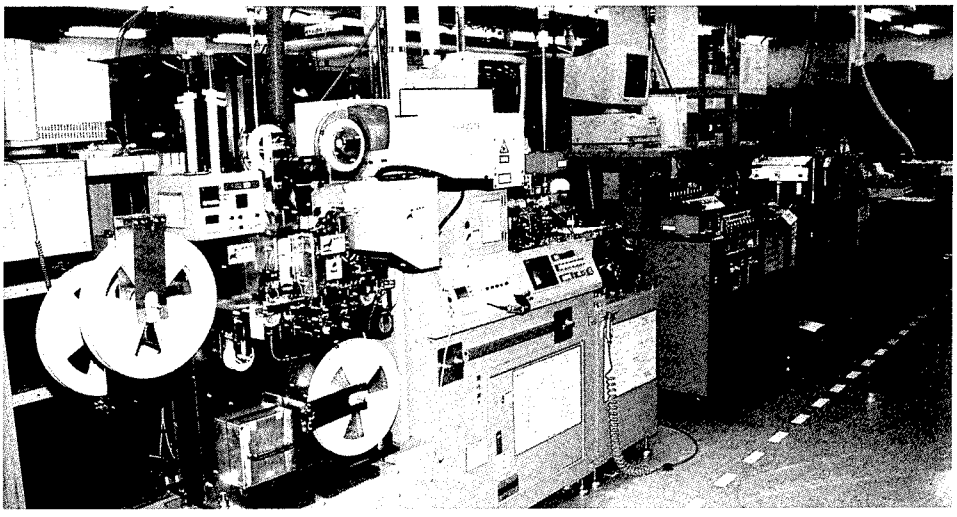


In these new sensors, changes in electric fields are detected by converting them into changes in optical signals.

(4) Optical Circulators



The optical circulator is a key device in large capacity two-way communications, and is ideally suited for optical ADM machines.



Power inductor checking and tape packaging line

Ion implantors in cleam room

Tokin Corporation
Tokyo Office, Corporate Planning Div., Planning & Publicity Office
Hazama Bldg., 2-5-8, Kita-Aoyama, Minqto-ku, Tokyo 107-8620
Tel. +81-3-3402-6163
Fax. +81-3-3402-6176

Shiroishi Plant
7-1-1, Asahi-machi, Shiroishi City, Miyagi Pref. 989-0223
Tel. +81-224-24-4111
Fax. +81-224-24-5892

TOPICS

This section describes selected developments of special importance or interest due to the achievement of a breakthrough or innovation in technology.

Stereoscopic Imaging Using No Special-Purpose Eyepiece

Ishikawa Optics & Arts Corp. has developed a Retro Reflective Zoning (RRZ) System enabling observation of three-dimensional images without having to use a special-purpose eyepiece, and has started selling a three-dimensional imaging system 3 DB-Vision that is an application of the RRZ system.

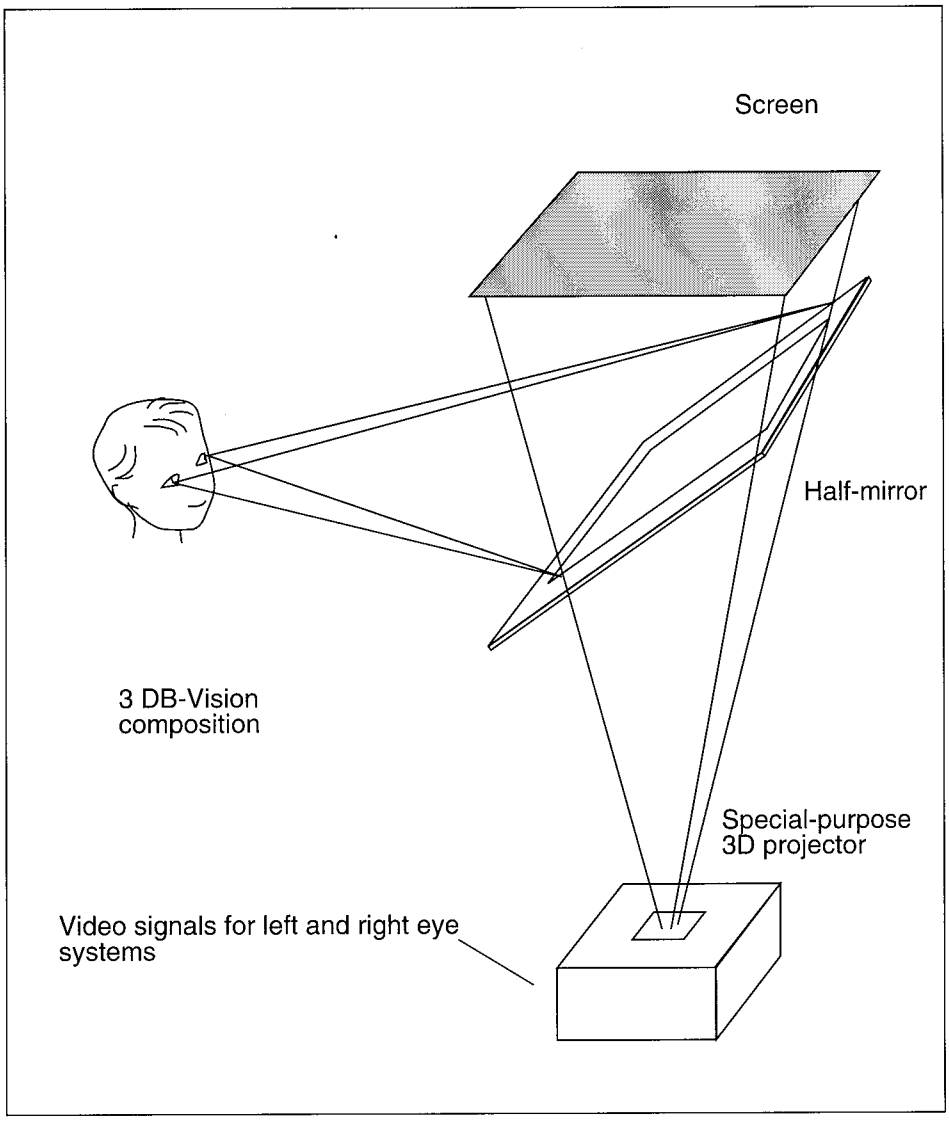
Normally, a special-purpose eyepiece is necessary to observe three-dimensional images, which is highly inconvenient and induces a sense of psychological resistance. Systems using special types of lenticular lens and no eyepiece are available, but these system are associated with inevitable image deterioration and limitation in display size. 3 DB-Vision enables naked eye stereoscopic vision without requiring any lens or other optical element that tends to become the cause of image deterioration. Quality three-dimensional images not available previously can be observed, the images are bright and can be observed on a large-size display of 120-in in a brightly illuminated room.

The RRZ system is a three-dimensional imaging system using a screen with directivity which sends the left image to the left eye position and the right image to the right eye position directly. The aberration-free optical system provides quality images free of distortion compared with the lenticular system. In addition, no disagreeable reversed images are generated.

The 3 DB-Vision system using the RRZ system is available in a wide range of types including the disk type, compact type, table type, wall incorporation type, mini-theatre type installed alongside the seat and lightweight type, and its use in combination with dioramas is also possible. The screen size can be designed flexibly within 20-120 in, and its images reflecting a sense of reality makes the system ideal for theme parks, show rooms, in design conferences and for scientific and artistic recordings.

A system with a screen size of 60 in is sold at a domestic price of about ¥5,300,000. The company plans to apply the system to simulation systems and game equipment.

* ***Ishikawa Optics & Arts Corporation***
2-15-14, Nishinakanobu, Shinagawa-ku, Tokyo 142-0054
Tel: +81-3-3785-6044
Fax: +81-3-3785-6560



Conceptual Diagram of RRZ System

7,000-M Deepsea Remotely Operated Vehicle Connected to Support Vessel with Thin Cable

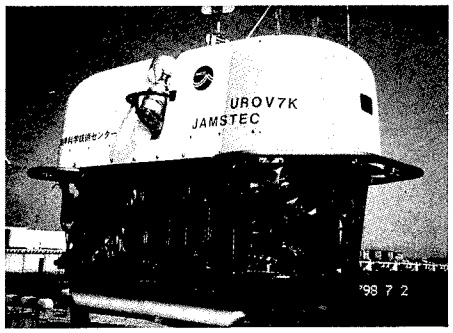
Japan Marine Science & Technology Center has completed fabricating an unmanned remotely operated vehicle UROV 7K that is designed to conduct deepsea surveys to depths 7,000 m below the sea surface.

With this UROV system, the battery providing the system motive force are mounted on the vehicle and an optical fiber cable with a diameter of 1 mm is used to interconnect on-board system and UROV. The support vessel and the UROV mount spoolers which pay out or reel in the optical fiber cable like a fishing reel to permit the UROV to navigate freely. The spooler is so designed as to feed the optical fiber cable even when weak forces are exerted on the vehicle by tidal currents.

In contrast to the conventional ROV mode of navigating by pulling in the cable, UROV maneuvers by placing the optical fiber cable along the course, so it is not restrained by the mobility of the cable. In addition, the UROV 7K cable is as long as 30,000 m, so the vehicle has a wide radius of activity.

Regarding the method of operation of the UROV system, the thruster is not used until the vehicle reaches the sea bottom, and it is lowered by the weight of its submergence ballast which is cast away when the vehicle reaches the sea bottom to assume a state of neutral buoyancy. From here, the thruster is used for navigation and for advancing survey activities. After completion of survey activities, the vehicle casts off its buoyancy ballast employed during navigation, severs the optical fiber cable and rises. After floating to the sea surface, it is recovered by the support vessel.

This is the ordinary method of UROV operation. If the optical fiber cable is severed inadvertently during the survey operations, the UROV floats to the surface by the same procedure adopted for rising subsequent to the completion of survey operations. Therefore, the UROV can conduct survey operations even at places where mooring cables exist or at places where there are obstacles, and the unmanned submergence vehicle can be recovered even if the cable is inadvertently entangled or severed.

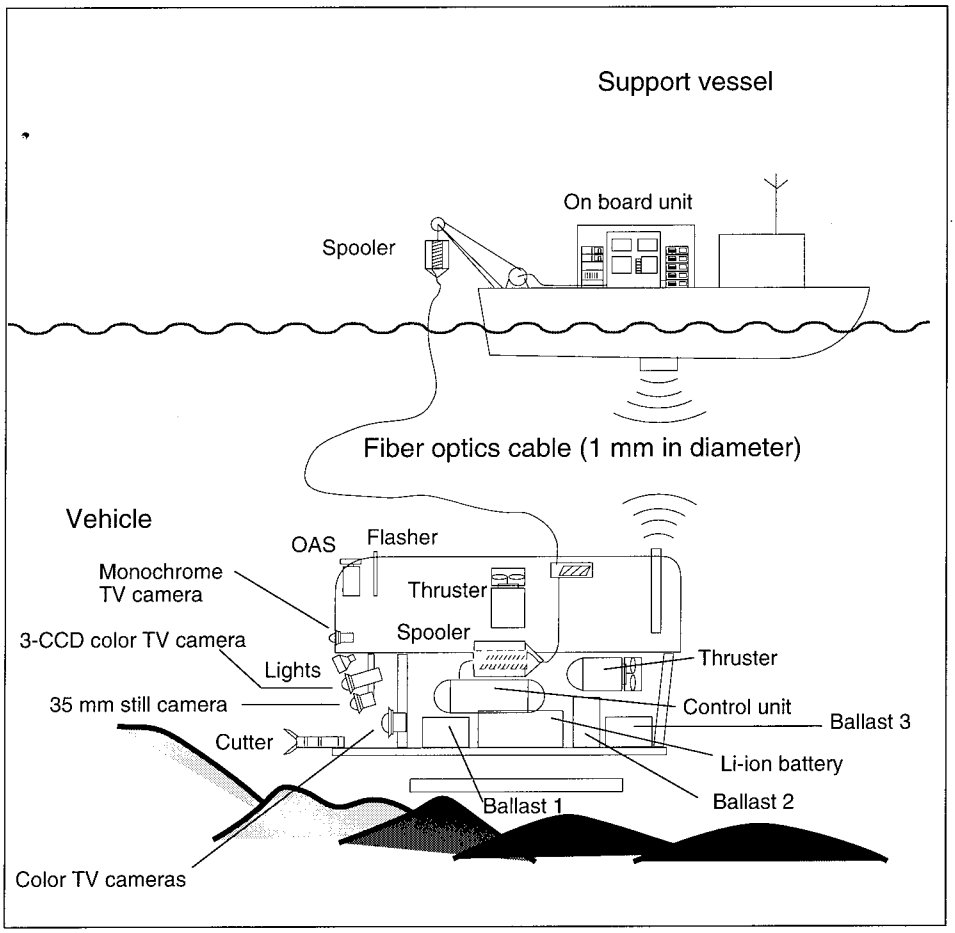


UROV 7K

The UROV 7K system under development this time mounts an optical transmission system for high-speed, large-capacity communications at about 640 Mbps. This optical transmission system is incorporated with an optical power monitor function to uplevel its reliability in the same manner as the ROV "Kaiko". The power system uses long-life, high-efficiency, rechargeable large-capacity lithium ion secondary battery (capacity 60 Ah).

Recently, marine echo tomography systems and marine observation buoy mooring systems have been installed in deepsea regions, and a few cases are arising of these mooring systems becoming unrecoverable. Under these circumstances, the development of a vehicle such as ROV had been needed with a cable not liable to entanglement with buoy mooring cables.

* ***Japan Marine Science & Technology Center***
2-15, Natsushima-cho, Yokosuka City, Kanagawa Pref. 237-0061
Tel: +81-468-67-5502
Fax: +81-468-65-8810



UROV 7K System

NATIONAL R&D PROJECTS

This section describes various R&D projects being carried out in Japan on a national scale.

* ***Agency of Industrial Science and Techonology, MITI***
Medical and Welfare Equipment Technology Office
1-3-1, Kasumigaseki, Chiyoda-ku, Tokyo 100-8921
Tel: +81-3-3580-6304
Fax: +81-3-3501-0576

Research to Develop Esophageal Vocalization Aid System

1. Project Objective

Today in Japan, there are an estimated 20,000 patients with pharynx cancer (16 patients per 100,000 population), and the number is increasing from year to year. These patients are deprived of their vocal chords due to pharynx removal surgery and therefore lose the function of speech. By training these persons in esophageal speech, or in the art of vibrating the upper parts of the esophagus in place of the vocal chords, they can hold a conversation.

However, esophageal speech has various disadvantages, such as failing to provide an adequate sound volume due to inadequate respiration, the fundamental frequency is low and rather disorderly, and a large volume of extraneous noise is involved such as stromatal noise.

Especially in outdoor environments where there is much surrounding noise, the speech intelligibility is frequently deteriorated considerably to prevent satisfactory communication. To cope with such problems, this research project will develop an esophageal vocalization aid system to permit these patients to engage in smooth conversations even in streets where there is much noise.

2. R&D Targets

The esophageal vocalization system uses a pickup to catch and convert esophageal speech into electric signals, then performs digital signal processing to convert these electric signals into voice signals which can be discriminated with ease even in streets, after which the magnified voice is output with a compact loudspeaker. The system selectively converts esophageal speech efficiently into electric signals, and further into speech, without being influenced so much by extraneous noises.

Therefore, research will be advanced to develop a portable esophageal vocalization aid system incorporating a compact loudspeaker of adequate output, which consists of a compact, lightweight voice pickup device that would selectively convert esophageal vocalization efficiently into electric signals without influences from extraneous noises, an optimum signal processing algorithm determined by an esophageal speech analysis system, and a special-purpose IC circuit, or a digital signal processor (DSP) middleware for signal processing in real time and with low power consumption. At the same time, a voice analysis system will be developed that would analyze the voice of the user beforehand and, based on the voice characteristics, would determine the specifications of the esophageal vocalization aid system.

3. R&D Setup

The enterprises in charge of the aid system development, the schedule of the R&D project and the development committee, are as follows:

Development enterprises
Matsushita Electric Industrial Co., Ltd.
TEAK Co., Ltd.
Ashida Acoustics Co., Ltd.
Medical & Welfare Equipment Laboratories, Co., Ltd.

Project schedule
FY 1994-FY 1998

Development committee
Chairman Hajime Hirose, Prof. of Medical and Sanitation Faculty, Kitasato University, and 12 other members

4. Present Technology Development

1) Voice Pickup Technology

A compact high-output loudspeaker of 57 mm diameter and a quality sound-com-

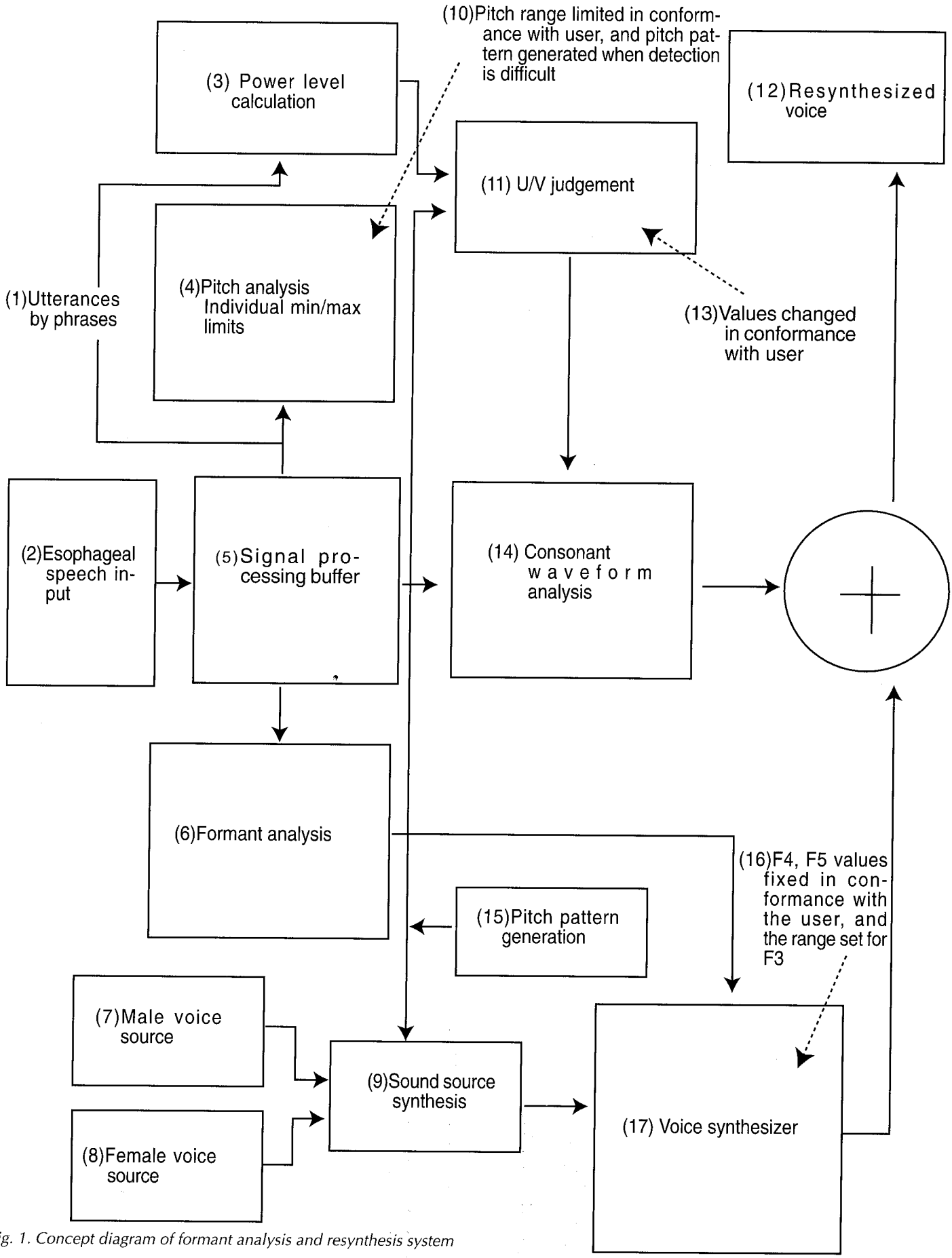


Fig. 1. Concept diagram of formant analysis and resynthesis system

patible loudspeaker of 77 mm diameter were developed. The 57-mm loudspeaker frequency characteristics were from 400 Hz to 7 kHz, and 500 Hz-6 kHz as accommodated in a cabinet, or adequate to cover the voice range. Further, a parallel arrangement differential microphone was developed that uses two 4-mm diameter microphone units enabling pickup of voices efficiently even in a noisy environment. Studies are presently in progress on a wireless microphone.

2) Voice Signal Processing Technology

The esophageal speech quality is deteriorated by the differences in the sound source or the vocal chord. Therefore, input esophageal speech is processed by formant (characteristic frequency region) analysis. Studies were made of a formant analysis and resynthesis system in which the voice source information and vocal tract information are first separated, then the voice source information (sound source) part resynthesized by using the voice source waveforms extracted from the voices of physically sound persons. Fig. 1 shows the concept system composition.

In addition to the development of the formant analysis and resynthesis system, research was advanced to develop a pitch control system to change the voice pitch, and an amplitude stabilization system to supplement inadequate power and improve amplitude instability.

3) Special-Purpose IC

A special-purpose digital IC unit incorporating a digital signal processor (DSP) has been fabricated experimentally. This IC unit features a function of digital signal processing in connection with the formant analysis and resynthesis system as well as the real-time pitch conversion and amplitude stabilization system.

4) Voice Analysis System

A voice analysis system was developed that permits the optimum signal processing method and control parameters to be selected with a personal computer in conformance with the user voice tone. This system has a function of downloading the parameters set for each user to the digital unit.

5) Total System

For use as a total system, an analog loudspeaker (61 mm × 92 mm × 27 mm, 200 g) specifically for loudspeaking was developed, as well as an esophageal vocalization aid system (92 mm × 130 mm × 38 mm, 350 g) incorporating a digital unit in the analog loudspeaker function. Fig. 2 shows the esophageal vocalization aid system incorporating the digital unit.

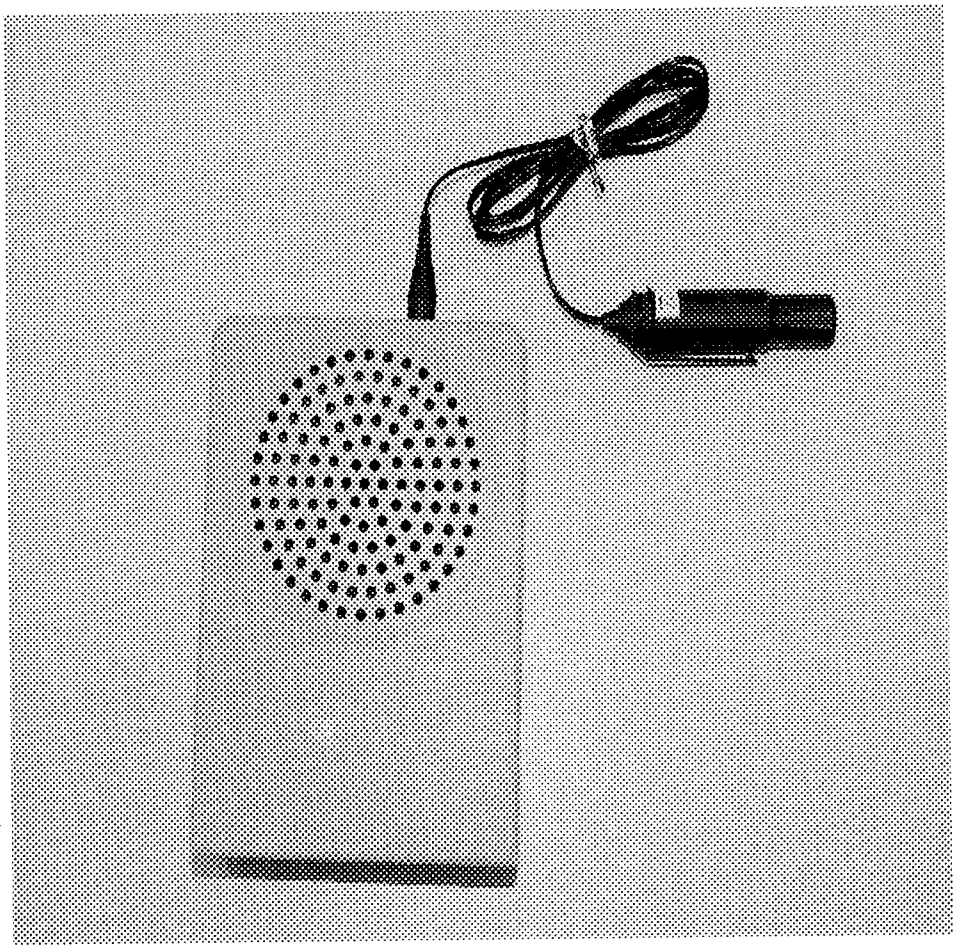


Fig. 2. Esophageal vocalization aid system

6) Overall Evaluation

The loudspeaking effect and the usability in a noisy environment were confirmed through a subjective evaluation of the analog loudspeaker system. Also, subjective evaluation tests were conducted of the formant analysis and resynthesis system, and improvements were made on 11 items in connection with the degree of clarity, degree of abnormality, and others. Regarding the evaluation of the sense of use of the analog loudspeaker system, desires were expressed for further miniaturization and for the development of a wireless microphone.

5. Summary and Future Schedule

The term of the esophageal vocalization aid system R&D project is from FY 1994 to FY 1998, and this year is the last fiscal year of the project. The basic algorithm has already been developed and system designs generally completed. The plan is to advance research in connection with the evaluation of the esophageal vocalization aid system and voice analysis system, including clinical evaluation, and addition of further improvements.

* ***New Energy and Industrial Technology Development Organization (NEDO)***
Medical & Welfare Equipment Dept.
1-1, 3-chome, Higashi-Ikebukuro,
Toshima-ku, Tokyo 170-6028
Tel: +81-3-3987-9353
Fax: +81-3-5992-0044
E-mail: qiry@nedo. go.jp

GENERIC TECHNOLOGY REVIEW

This section describes various basic research and development activities in Japan to inform the world about generic R&D efforts here.

Ultra-refinement of the Microstructure of Metallic Materials by Micro-explosion

Research on Development of Novel Technology for Future Chemical Reactions by Clarifying Microscopic Structures Affecting Reactivities at High Temperatures and Pressures

* ***Agency of Industrial Science and Technology, MITI***
Research Administration Division
1-3-1, Kasumigaseki, Chiyoda-ku, Tokyo 100-0013
Tel: +81-3-3501-1777
Fax: +81-3-3501-7899

Ultra-refinement of the Microstructure of Metallic Materials by Micro-explosion

National Industrial Research Institute of Nagoya
Kenji Miwa

FY 1997-2001 (5 years)

Summary of Project

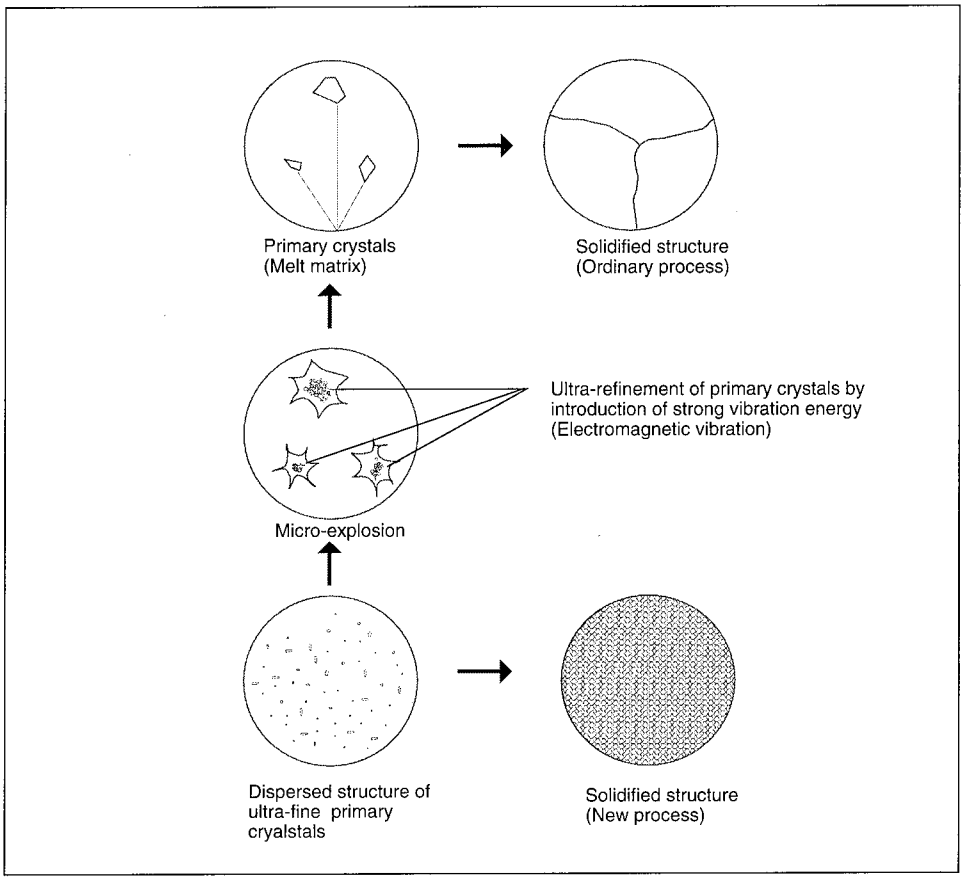
The aim of this project is to develop processing technology for ultra-refinement of the microstructure of metallic materials by taking advantage of the micro-explosion phenomenon. Micro-explosions occur in a molten metal when micro-cavities made by strong electromagnetic vibration or ultrasonic waves are crushed. When a molten substance is solidified in the presence of micro-cavities, the primary crystal is broken into ultra-fine pieces by the shock wave due to the micro-explosion and thus the dimension of the final crystals in the solidified metal is greatly reduced.

Significance of Research

Introduction of a strong vibrational energy into a molten metal in the course of solidification allows the creation of an advanced metal with ultra-fine microstructures. This was confirmed by the present group for the first time. This type of new metals is expected to have much better mechanical properties in addition to better corrosion resistance.

Effects on Industry

A new line of advanced metals with much better mechanical and chemical properties will be produced with this technique, which reduces the grain size by one or two orders compared with currently available materials. Since an unprecedented improvement in mechanical properties will be achieved, lighter metal can be used in transportation, construction and electronic equipment, and so on. These new devices will have greatly increased energy efficiency and thus reduce the emission of carbon dioxide.



Research concept

Research on Development of Novel Technology for Future Chemical Reactions by Clarifying Microscopic Structures Affecting Reactivities at High Temperatures and Pressures

Tohoku National Industrial Research Institute (Main institute), National Institute of Materials and Chemical Research
Dr. Yutaka Ikushima and others; 14 persons (+ Tohoku University: 3 persons) FY 1997-2002

Summary

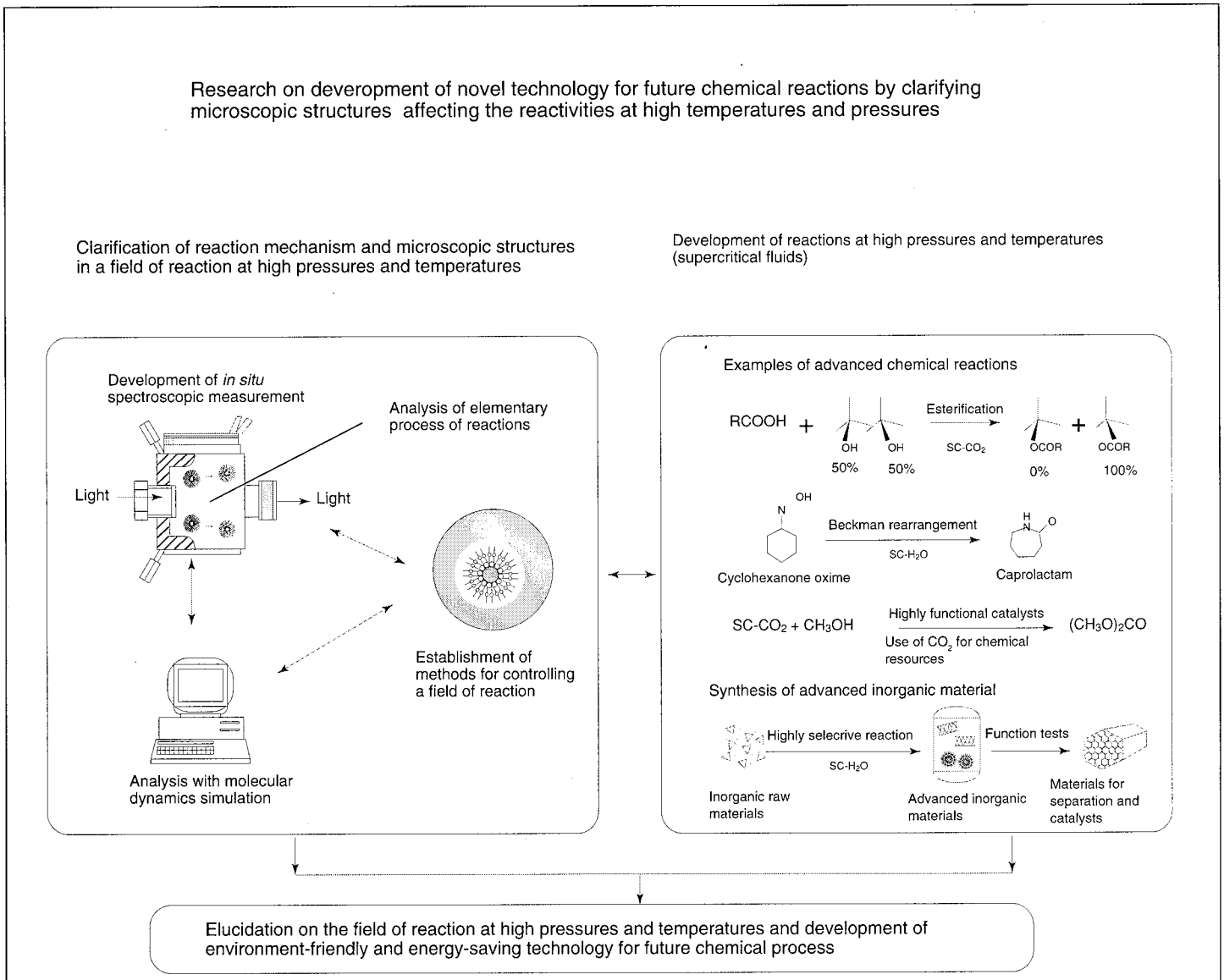
The objective of this research is to achieve greatly increased chemical reactivities through elucidation of microscopic properties in the field of reaction under high pressures and temperatures, such as supercritical fluids. Elemental processes of the reactions will be clarified by analyzing microscopic structures of solvent and reaction dynamics using computer simulations or special spectroscopic measurements developed in this research. This research can thus provide technology essential to future synthetic methods for organic and inorganic materials in high yield and high selectivity.

Significance of Research

Clarification of dynamics and mechanism of reactions at high pressures and temperatures can achieve a great increase in reaction efficiency and reaction selectivity, and lead to the establishment of novel technology chemical reactions, which will contribute to the solution of serious environmental problems such as decontamination and to effective utilization of natural resources without harmful solvents or acidic catalysts.

Effects on Industry

Technologies will be developed for the production of materials which will achieve better protection of the environment, chemical recycling processes and synthetic methods of advanced inorganic materials. These techniques will contribute to the development of new chemical Industries.



98-08-100-01

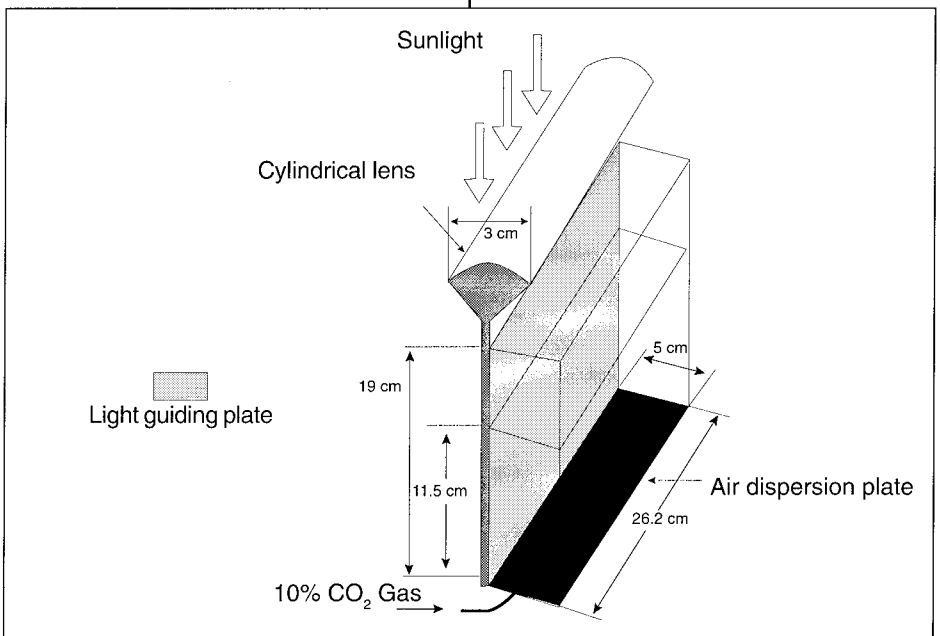
Novel Sunlight Introduction by Light Guide Plate and Construction of Efficient Algal Biomass Production

Prof. K. Miyatake, Department of Applied Biological Chemistry, Osaka Prefecture University, and his research team have established "A new sunlight introduction device based on a light guiding plate and have constructed of an efficient algal biomass production system". This system has about 40 times greater biomass production than that of existing crop production, and can reduce atmospheric CO_2 by photosynthetic fixation. This algal biomass is usable as feed for domestic animals.

In this research, Euglena gracilis Z was cultured aseptically in Cramer and Myers medium under sunlight for 10 days by bubbling enriched air with 10% CO_2 (v/v). The light intensity of sunlight is high (the maximum photon density of visible ray is 1,500 mmol photon/m^2/sec or greater), exhibits diurnal variation and fluctuates greatly depending on weather and seasons. These factors can greatly influence the productivity of biomass, Euglena. Based on the experimental results obtained using artificial light, the culture bath was constructed into which 10% CO_2 was supplied, to investigate Euglena culture under sunlight. The number of photons of visible rays in the sunlight supplied into the bath were to determine the efficiency of the light energy in photosynthesis. The maximum light energy efficiency obtained in the culture using sunlight was approximately 30%. This indicated that, without altering the method of introducing light into the bath, Euglena biomass production with approximately 30% light-energy efficiency is possible under sunlight. Although this figure is about 20 times greater than that of existing crop production, it is still rather low compared to that obtained using artificial light emitting diode. Therefore, by improving the method of introducing sunlight into the culture bath, an increase in the efficiency of light energy to photosynthesis can be realized.

A novel light-introduction system using a light-guiding plate is being developed. The newly developed culturing system is schematically shown in Fig. 1. The top part is the cylindrical lens where the sunlight is introduced to the inside of the culture tank after collection, and is diffused all over the side of a transparent board via a corner of a board containing an irregular reflection layer. Rather than irradiating sunlight with high light intensity onto the top of the culture tank, this system allowed a uniform supply of sunlight all over the inside of the culture bath from the side, once the photon density has been reduced to the level most suited to the culture. Little photon loss occurred within the light-guiding plate, and almost all of the sunlight collected by a cylindrical lens was supplied to the inside of the culture tank via an emission surface of the light-guiding plate. By attaching a cylindrical lens to the existing light-guiding plate and diluting the intensity of sunlight to approximately 1/7, the maximum efficiency of light energy to photosynthesis was increased to 60%, just two-fold of the direct sunlight culturing system. This result indicates that Euglena consumes a given amount of light energy without wasting any on the synthesis of cell components to multiply themselves, provided that the culture conditions, such as CO_2 concentration and light intensity, were properly set and the direct increase of biomass production which corresppondes about 40 times greater than that of existing crop production. Further improvement in the cylindrical lens and light-guiding plate may result in a further increase in light-energy efficiency. The Euglena cell contained more micronutrients, such as vitamin and minerals, than yeast. Therefore, the resulut of research suggests that such Euglena cells should be available as a sole nutrient source in the future. At present, 1.5 g of dry weight of Euglena cell is obtained per liter medium and this results seems to make possible the development of a biomass-production system for animal feed or nutrient sources by the biological fixation of CO_2 and CO_2 reduction in the atmosphere.

* ***Osaka Prefecture University***
Department of Applied Biological Chemistry, Biocycle Engineering Laboratory
1-1, Gakuen-cho, Saai City, Osaka 599-8531
Tel: +81-722-54-9467
Fax: +81-722-54-9467
E-mail: miyatake @ biochem. osakafu-u.ac.jp



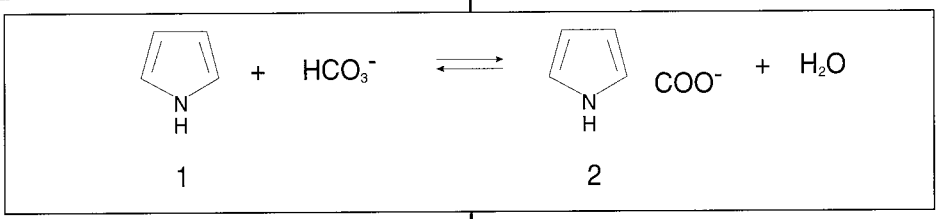
Algal culturing system with light guiding plate

98-08-100-02

Microbial Synthesis of Pyrrole-2-Carboxylate by *Bacillus megaterium* PYR2910

Prof. Nagasawa and his team of the Faculty of Engineering, Gifu University, has developed technology for microbial synthesis of pyrrole-2-carboxylate by *Bacillus megaterium* PXR2910.

C-C bond forming enzymes are of interest for preparative organic chemistry. Pyrrole-2-carboxylate decarboxylase from *Bacillus megaterium* PYR2910 catalyzes the decarboxylation of pyrrole-2-carboxylate to stoichiometric amounts of pyrrole and bicarbonate (HCO_3^-). The enzyme was



also found to catalyze the reverse carboxylation of pyrrole (1) to pyrrole-2-carboxylate (2) after addition of HCO_3^-.

The concentration of solubilized HCO_3^- was the carboxylation limiting factor. Therefore, saturating amounts of $KHCO_3$ (3M) were used leading to a shift of the reaction equilibrium towards the carboxylate. HCO_3^- addition was accompanied by CO_2 gas evolution resulting in an increased pressure in the tightly closed reaction vessel to 1.38 atms. The increased pressure supported the reverse reaction yield by 2.5-fold compared to atmospheric pressure. High pressures are also applied in organic synthesis carboxylations. As biocatalyst, conecentrated cells with an optical density at 610 nm of 40, previously grown under inducing conditions, were employed. Additionally, acetate as enzyme cofac tor and L-ascorbate as an antioxidizing enzyme protection agent were added to the reaction mixture. As a result of carbon and oxygen incorporation, 36.1 g/l (325mM) pyrole-2-carboxylate were formed from 26.8 g/l (400 mM) pyrrole. The yield after bioconversion was 81%, limited by the equilibrium.

The product was isolated by centrifugation of the reaction mixture (40000g, 30 min) and applying the supernatant to a Dowex-1 (Dow Chemicals, USA) anion exchange chromatography column previously equilibrated with water. Water was used to wash out pyrrole. The product was eluted with 2 M acetic acid, concentrated in a vacuum evaporator and crystallized in H_2O. The crystals were identified as pyrrole-2-carboxylate by NMR and infrared spectroscopy using authentic pyrrole-2-carboxylate as reference. The overall yield after isolation was 52%.

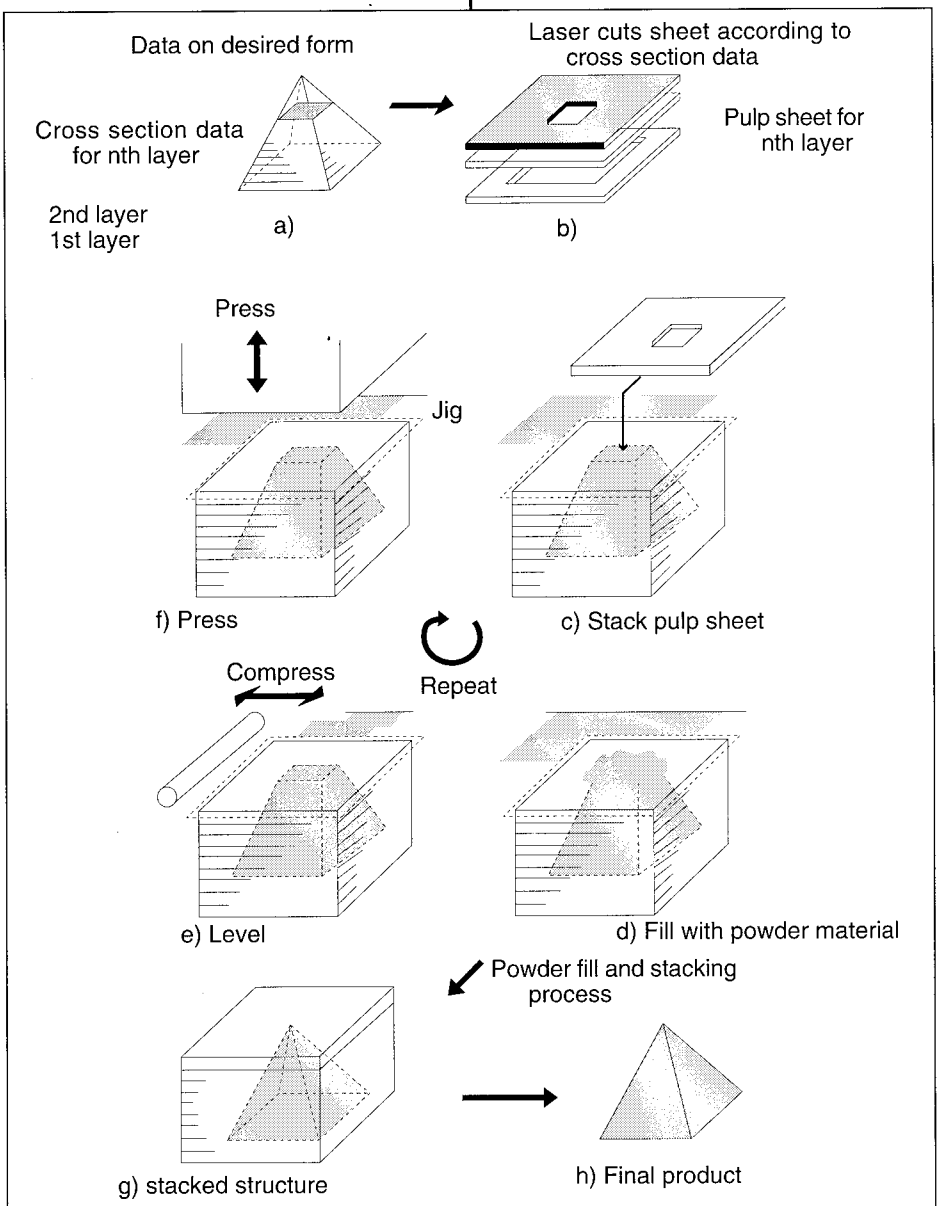
Pyrrole-2-carboxylate is employed in the synthesis of various pharmaceuticals and a potential herbicide. A number of organic syntheses were described including the reaction of pyrrole magnesium bromide with powdered solid CO_2, the treatment of 1,2 oxazines, obtained by reacting butadienecarboxylic esters with nitrosobenzene, with a base in ethanol, the addition of toluene-*p* sulphonylglycine to α,β-unsaturated ketones and the formylation of pyrrole to the 2-aldehyde and further oxidation with alkaline silver oxide. However, these syntheses require multiple steps and result in low yields. Furthermore, the chemical carbonation of pyrrole with K_2CO_3 requires high pressure and temperature. The one-step bioconversion described here has advantages in regiospecificity, yield and mild reaction conditions.

** Gifu University*
Faculty of Engineering
1-1, Yanagido, Gifu City, Gifu Pref. 501-1193
Tel: +81-58-293-2647
Fax: +81-58-293-2647
E-mail:tonagasawa@apchem.gifu-u.ac.jp

98-08-100-03

High Performance Metal Rapid Phototyping Process by Free Sintering Method

Prof. Hiromu Nakazwa, Department of Mechanical Engineering, School of Science and Engineering of Waseda University, has improved the previously developed rapid phototyping process by the free-sintering method for metal, to produce the final metal products with an efficiency of more than 90%. The importance of the



Process flow of free sintering

metal rapid phototyping process is widely recognized in various fields, and research is promoted aggressively, but there are few technology and processes to produce high density products from various metallic materials not established at present. Therefore, Prof. Nakazawa aimed to establish an applicable metal rapid phototyping process, and developed free sintering methods.

This method consists of the following steps (refer to process flow sheet): A product is designed using 3D CAD or some other means, and horizontal slice data are taken based on the thickness of the pulp sheet (a). Pulp sheets are cut out according to the slice data by laser (b). A cut pulp sheet is placed on the stack (c). The gap space in the pulp stack is filled with powdered metal materials, and the top is leveled (e). Pressure is applied (f). Steps 3 - 5 are then applied. The stack is secured in a jig, then sintered in an oxygen-free atmosphere (g). The pulp sheets, which have become carbonized by heat, are removed to reveal the final product (h).

In the free sintering method, there is no need to coordinate various processing levels, when parts are fabricated separately to be assembled later, or to consider intermediate steps normally employed with conventional metal or sand dies. So, this method has the following features: A wide range of materials is usable. Complicated shapes can be fabricated easily. Fast fabrication is available.By successful improvement, metal rapid phototyping will be commercialized in the near future.

* ***Waseda University***
Department of Mechanical Engineering, School of Science and Engineering
3-4-1, Okubo, Shinjuku-ku, Tokyo 169-0072
Tel: +81-3-5273-4659
Fax: +81-3-5273-4659

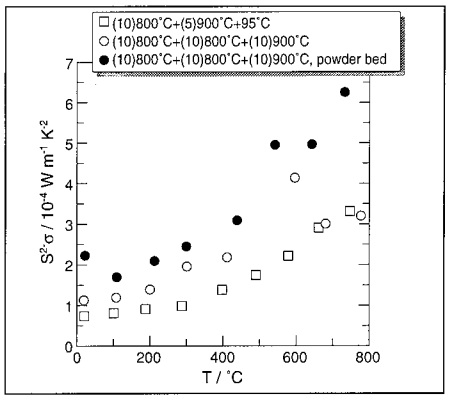
98-08-100-04

Sintered Sodium Cobaltite with High Thermoelectric Performance as P-type Oxide Candidate

Assoc. Prof. M. Ohtaki, Graduate School of Engineering Sciences, Kyushu University, has developed metal oxides Na_xCoO_2 in a delafossite ($CuFeO_2$)-related crystal structure and confirmed most excellent thermoelectric properties as p-type oxide materials in the temperature range from room temperature to 700 °C.

Sintered Na_xCoO_2 (x=0.5) was prepared by conventional solid-state reaction from powder Na_2CO_3. Powders were mixed in a nylon-lined ball mill for 24 hours, and calcined at 800 - 900 °C for 12 hours in air. The resulting mixtures was pulverized with 5 - 10 mol% of excess Na_2CO_3, and calcined again. The powder was again mixed with excess Na_2CO_3, and pressed into pellets, and then sintered at 800 - 950 °C for 12 hours in air. The relative densities of the sintered samples were determined by Archimedes' method. The 4-wire measurement of the electrical conductivities, and the steady-state measurement of the Seebeck coefficient, S, were simultaneously carried out on the same sample bar of 5 mm × 3 mm × 15 mm.

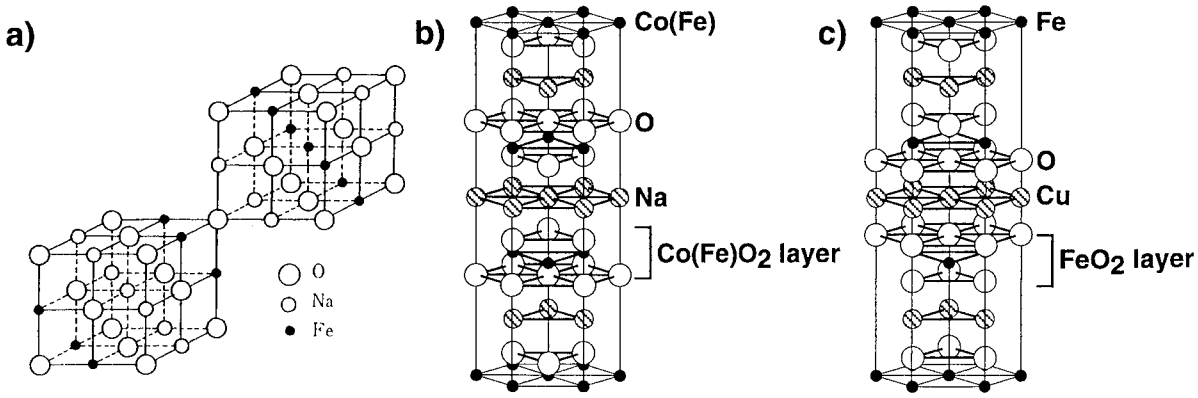
Probably due to the losses of Na during firing, the electrical properties of the oxides were sensitive to the heating atmosphere. The oxides show almost temperature-independent electrical conductivities of $>10^2$ Scm^{-1} up to 1,000 K, and S of >100 μVK^{-1} increased linearly with temperature.



The power factor of zNa_xCoO_2 prepared by various calcining and sintering temperatures. Molar% of excess Na_2Co_3 added at each firing are shown in parentheses

Although the poor sinterability of samples at present state limits the conductivity, the oxides show a power factor value $>6\times10^{-4}$ $Wm^{-1}K^{-2}$ at 1000 K. Since the thermal conductivity of the oxides was measured as 1.5 - 2.5 $Wm^{-1}K^{-1}$ at room temperature, and is usually expected to become lower at higher temperature, the maximum value is anticipated to reach $>0.4 \times 10^{-3}$ K^{-1}. The oxide was thereby confirmed to be the most promising p-type oxide candidate so far investigated.

* ***Kyushu University***
Graduate School of Engineering Sciences
6-1, Kasugakoen, Kasuga City, Fukuoka Pref. 816-8580
Tel: +81-92-583-7465
Fax: +81-92-573-0342
E-mail. ohtaki@mm.kyushu-u.ac.jp



(a) α-$NaFeO_2$ (cubic symmetry), (b) β-$NaFeO_2$ (hexagonal symmetry), and delafossite ($CuFeO_2$) structures

NEW TECHNOLOGY & PRODUCTS

Advanced Materials

98-08-001-01

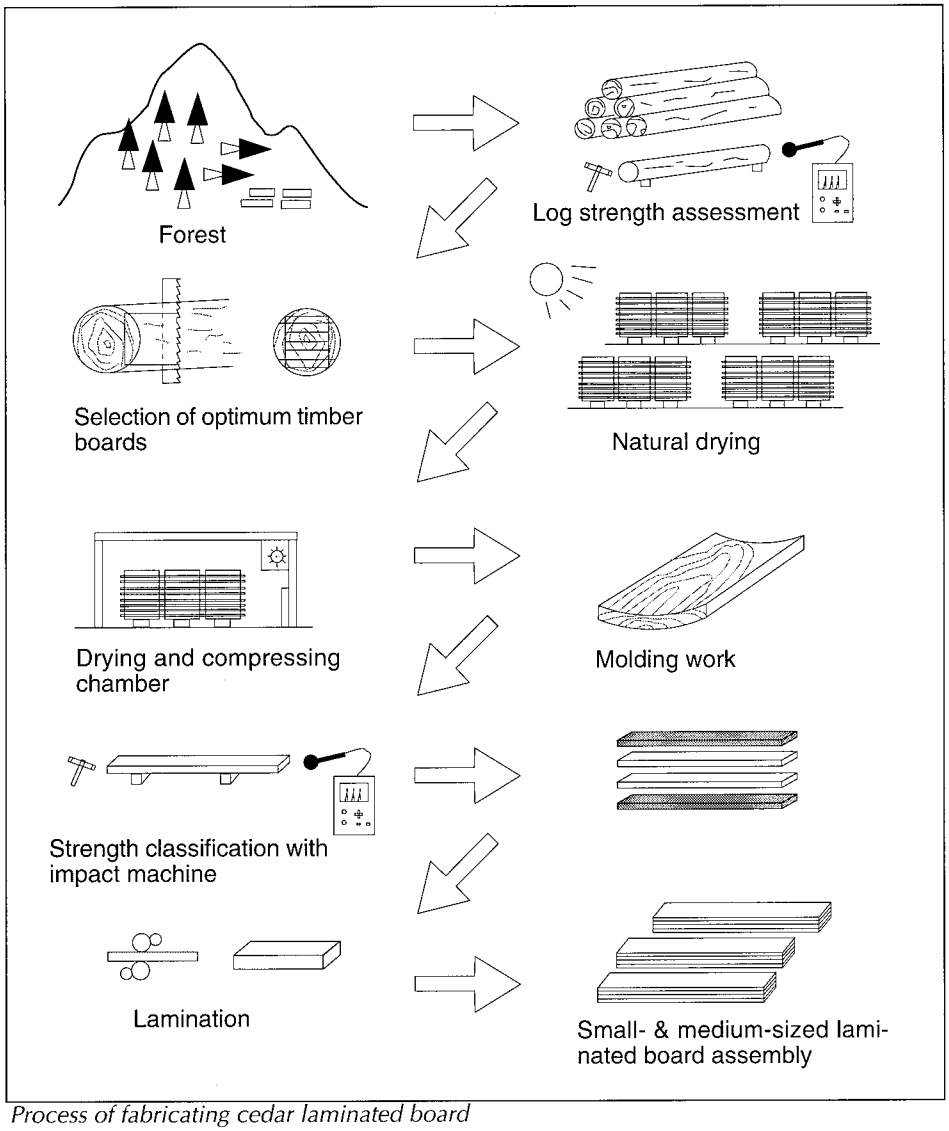
Small- & Medium-Size Laminated Board Assembly Manufacturing System

The Kagoshima Prefectural Institute of Industrial Technology has developed a Small- and Medium-Size Laminated Board Assembly Manufacturing System that utilizes cedar boards.

The small- and medium-size laminated board assembly has less dimensional and strength disparities than ordinary laminated board assemblies made of natural timber of diversified characteristics. The prototype board assembly costs about ¥90,000/m^3, slightly higher than a board made of natural timber, but meticulous processing in the manufacturing plant lowers the total construction cost subsequently through a reduction of worksite machining tasks and shortening of construction schedules.

With the new manufacturing system, the log strength is first assessed and optimum boards selected, which are then dried and shaped properly by woodworking machines. Next, the strengths of the shaped boards are classified by testing with an impact machine, after which the weak boards are laminated inside and the stronger boards laminated toward the surface. Four of these boards are used together for fabricating housing pillars. The center has developed a grading machine to classify the board strengths, and a continuous laminating system is presently under development.

Kagoshima Prefecture has an abundance of cedar trees which are 26-35 years old and ready for felling. However, the cedar board has a dark core and is rather moist, while the annual ring is wide and the timber rather weak, so the timber has not been utilized effectively. These disadvantages have been overcome by fabricating the timber in lamination, so the pre-



Process of fabricating cedar laminated board

fecture observes that the new laminated material can be utilized effectively as a housing material.

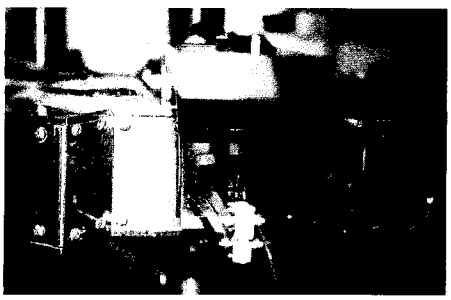
* *The Kagoshima Prefectural Institute of Industrial Technology*
1445-1, Oda, Hayato-cho, Aira-gun, Kagoshima Pref. 899-5105
Tel: +81-995-43-5111
Fax: +81-995-64-2111

98-08-001-02

New Ceramic Composites for Engine Nozzle Parts of Satellites and Wings of Spacecraft

The National Aerospace Laboratory of Japan (NAL) of the Science and Technology Agency has developed SiC-based PC ceramic matrix composites (CMC) by doubling the tensile strength at 1,100 °C compared with conventional ones, with the cooperation of Ube Industries Ltd., Shikibo Ltd, and Kawasaki Heavy Industries, Ltd. (KHI). The ceramic composites are based on heat resistant fabrics consisting of Si-Ti-C-O fibers (Tyranno). This fabric is first woven three dimensionally, and impregnated with a high-polymer liquid of a similar composition with the fiber, then the fabric is sintered for making ceramic composites. Next, the ceramic composites are sealed with glass sealant at the vacuum condition. By applying this sealant, static strengths in high temperature air up to 1,100 °C were 90% of the high temperature strength in vacuum.

The creep test for new ceramic compos-



Creep text of new ceramic matrix composites at 1100 °C. (Center part)

ites showed superb creep rupture time, 700 hours (4 weeks) at 140 MPa in air at 1,100 °C. The static tensile strengths in high temperature air were improved to be several times those of unsealed samples and equalled the high temperature strengths in vacuum. Creep tests show that present CMC with the sealant exhibits excellent creep rupture strength of almost twice of the existing CVI-CMC (Chemical Vapor Infiltration-Ceramic Matrix Composites). The results suggest that the present sealant does not decompose so fast at 1,100 °C, or even 1,200 °C. However, a slight effect of decomposition was found in the time range longer than 100 hours. Application of this material to space propulsion components exposed to 1200 °C is being undertaken now.

* *National Aerospace Laboratory of Japan*
7-44-1, Jindaiji Higashi-machi, Chofu City, Tokyo 182-8522
Tel: +81-422-47-5911
Fax: +81-422-31-6198

98-08-001-03

Monoliquid Type Epoxy Resin Adhesive Requiring No Hardening Agent

The Yokohama Rubber Co., Ltd. has started marketing a newly developed monoliquid type epoxy resin adhesive Adguard PC-1 for use when constructing bridges and roads. This marks the first commercialization of a monoliquid epoxy resin adhesive that is hardened at room temperature and humidity.

When constructing bridges and expressways, the main structural members are constructed by the precast concrete (PC) block method of producing the concrete blocks in a factory, then assembling them at the construction site. To bond the PC blocks together, an epoxy resin adhesive displaying a powerful bonding strength is used frequently, but previously, only a biliquid type had been available which required the main adhesive and the hardening agent to be mixed together at the site.

Adguard PC-1 is a monoliquid type adhesive that reacts with the water inside concrete or in the atmosphere and which is hardened at room temperature and humidity. By merits of a special type of molecular design and blending technology, long-term storage with stability has been realized which had been quite difficult previously. Since it is a monoliquid type, there is no need to mix ingredents at the worksite, and quality disparity caused by scaling errors is prevented. Also, compared with a biliquid type, it generates a minimal hardening heat and is therefore usable over a long time, which enables a broader area to be finished in a given project, which translates into substantial labor conservation and rapid completion of work schedules.

In addition, this new adhesive does not directly use any hardening agent that is the cause of skin irritation and generation of offensive odors, or has little adverse influence on the human body compared with the conventional biliquid type. In addition, a single monoliquid type container suffices, so the generation of industrial wastes such as waste containers and washing solvents is decreased considerably.

Adguard PC-1 has already been confirmed to display excellent performance in the bonding of T type PC block bridges at several places within the country. Yokohama Rubber plans to apply this monoliquid epoxy resin adhesive technology to the earthquake resistance reinforcement of concrete structures and for the repair of cracked structural materials, also to the development of new construction adhesives and functional paints.

(Note): Adguard PC-1 is available exclusively in Japan.

* *The Yokohama Rubber Co., Ltd.*
Corporate Communications Dept.
5-36-11, Shinbashi, Minato-ku, Tokyo 106-8685
Tel: +81-3-5400-4501
Fax: +81-3-3432-8430

98-08-001-04

System for Measuring Thin 0.1-Micrometer Film Materials with Single Unit

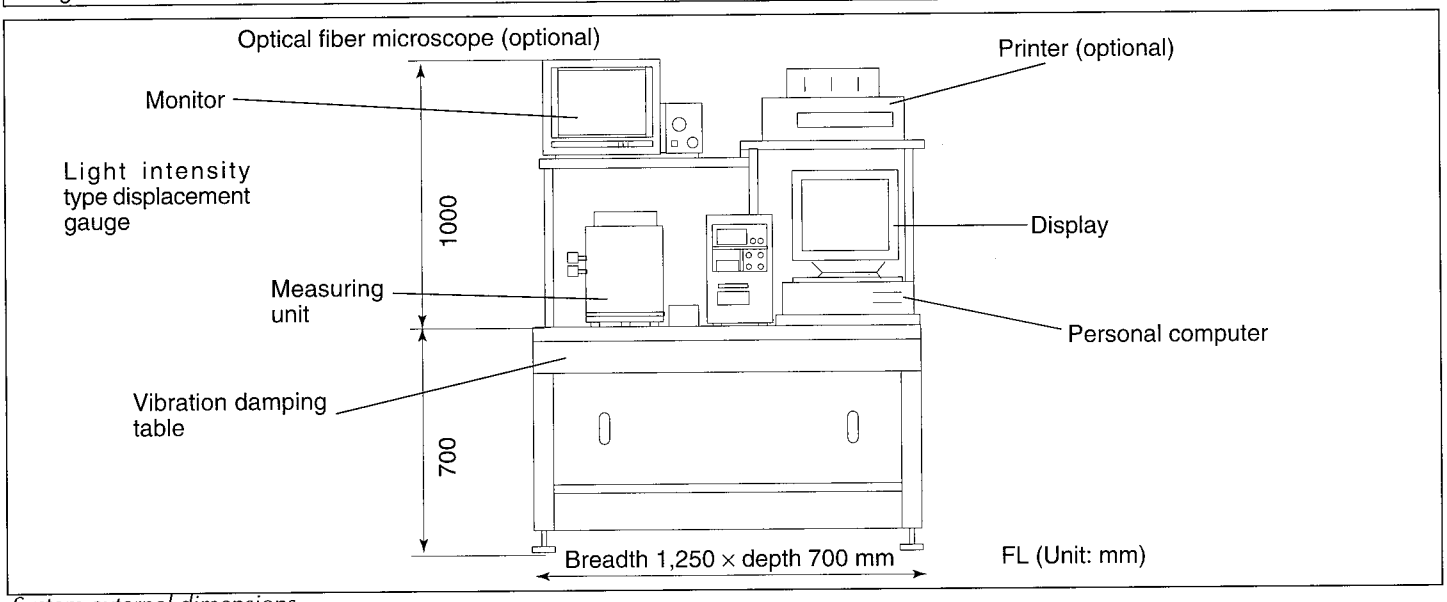
NEC San-ei Instruments, Ltd. has developed a Thin Film Material Evaluation System MH 4000 that enables thin film materials in the domain of 0.1 μm to be measured with a single instrument.

The measurement domain for evaluating the performances of thin films is shifting from the sub-micron domain to the sub-sub-micron domain, demanding measuring instruments of higher measurement accuracies. The new system enables the hardness, adhesive strength, Young modulus and internal stress of thin film materials lying in the 0.1-mm domain to be measured accurately with a single unit without having to change the measurement instrument.

The hardness can be converted into Vicker's hardness, and in the micro indentation tests conducted for measuring the adhesion strength, the measuring instru-

Main Specifications

Load range	0.1 mgf-10 gf (load detection resolution 0.01 mgf) (0.98 μN-98 μN (0.098 μN))
Indentation depth measurement range	0-5 μm (displacement detection resolution 4 nm)
Indenter	Target angle 80 degrees, triangular indenter
XY axes shift distance	±5 mm (both axes)
Specimen size	20 × 20 mm, t = 5 mm max.
Specimen weight	30g max.
Working conditions	Temp. 10-35 °C, humidity 20-80%
Power source	AC 100 V
System size	Breadth 1,250 × depth 700 × height 1,400 mm (with printer mounted)
Weight	250 kg approx.



System external dimensions

ment (optional) was confirmed to conform to Japanese Industrial Standards (JIS) requirements. Also, regarding the Young modulus (optional), measurements are possible accurately and with ease by the 3-point bend testing and measurement method, and the internal stress can also be derived very accurately from the warping degree.

The measuring system is marketed at a domestic price of ¥9,800,000, and the company anticipates orders for the instrument from the manufacturers of electronic devices (semiconductors), magnetic disk-related devices, displays (LCDs), optical materials and various types of polymer multilayered films.

* ***NEC San-ei Instruments, Ltd.***
1-57, Tenjin-cho, Kodaira City, Tokyo 187-8515
Tel: +81-42-342-6429
Fax: +81-42-342-6787

Electronics & Optics

98-08-002-01

Semiconductor Vacuum Printing and Packaging System

Toray Engineering Co., Ltd. has developed the first semiconductor vacuum printing and packaging system. This new system is an application of the printing method using perforated plate in a vacuum. Liquefied resin is supplied while removing the air bubbles and the resin packed and permeated by applying a vacuum-level differential pressure, followed by finish printing by a new method developed by the company. The system is ideal for application to mass production lines.

With the CSP flip chip process requiring underfill, the vacuum printing differential pressure is important. In underfill performance tests of chips with 3,000 bumps/18 mm^2, the conventional method that enables filling merely on a limited number of chips when the bump heights become low was discovered to enable rapid filling with respect to a wide range of resin viscosities at room temperature by applying the differential pressure method, and few voids were generated.

A CSP strip wafer of 48 × 210 mm was filled at a rate of 6-24 s/unit (in case of VPE-103 system), which is 2-8 times that of the transfer mold process and 4-16 times that of the dispense process. The cost of the vacuum printing process that uses liquefied resin will be rather high compared with the transfer mold process that uses powdered resin, but with the transfer mold process the resin is not used effectively and there is a substantial loss, so the resin cost

will not differ much between these two processes. In addition, the vaccum printing process requires no mold, which is advantageous over the transfer mold process in which the mold cost assumes a substantial ratio of the overall cost. The overall assessment is that the vacuum printing process displays a much better profitability in view of the improved productivity and mold cost elimination.

The process features a universal utility of perforated plate mask changing and applicability to resin sealing and filling in the three fields of globe top mold, underfill and peer hole in connection with semiconductor mounting. This technology has already been patented in these three fields. The domestic selling price of the VPE-102 system for diversified products in small lots is ¥25-35 million, and that of the VPE-103 system for mass production ¥35-50 million.

In the face of the growing need for CSPs and ball grid arrays (BGAs) of ever smaller mounting areas and higher reliability levels, the new process features substantial productivity improvement, enables securing of higher levels of voidless quality, permits the use of resins of even higher viscosities and enables filling at room temperature compared with the conventional dispense process, printing process and transfer mold process, and is anticipated to come into wide use as an innovative system to replace conventional processes. In addition, the introduction of multilayered wiring plates using plastic wafers has already started, making filling into peer holes and through-holes necessary, so the new process of excellent performances is gaining more attention.

Liquefied resins of excellent quality and applicability have already been confirmed as applicable, together with resin manufacturers, but research is being advanced further with resin manufacturers on related systems and resin applicability with the objective of promoting the wider use of the vacuum printing process and of expanding the applicability of a wider range of resins.

* ***Toray Engineering Co., Ltd.***
3-3-16, Hongoku-cho, Nihonbashi, Chuo-ku, Tokyo 103-0021
Tel: +81-3-3241-1769
Fax: +81-3-3271-7359

98-08-002-02

Die Developed for 0.25-Mm Connector Contacts

Suzuki Seisakusho Co., Ltd. developed a die and a stamping technology based on the use of a high-speed precision press and has succeeded in establishing a technology to manufacture connector contacts (metal parts for joint parts) with a pitch of 0.25 mm.

The commercialization of the 0.25-mm pitch connector contacts actually precludes the development of the mounting technology whose development is delayed, but the company intends to maintain a competitive edge over pressworking enterprises by making promoting the newly established technology.

Connector contact manufacturing technology is becoming increasingly advanced and complicated in the face of the existing trend for the miniaturization of notebook type personal computers, portable telephones and other electronic equipment. At present, the 0.5-mm pitch connector contact is the smallest available on the market, and miniaturization is expected to proceed further, so the company developed the 0.25-mm pitch products this time.

The main characteristics of the new technology are that there is no dimensional disparity when producing the products in big lots, and that there is hardly any draft impropriety that becomes problematical when bending the connector contact points. The die has been confirmed to withstand revolutions of up to 800 spm and high-speed mass production through the experimental fabrication of connector contacts, and the punching accuracy is ±2 μmm. The die and its machining cost are about the same as before.

The company aims to establish a precision pressworking technology capable of competing with the narrow-pitch etching technology. The technology is applicable to the mass production of low-priced flexible printed circuit wafers and the company plans to expand the range of its pressed products.

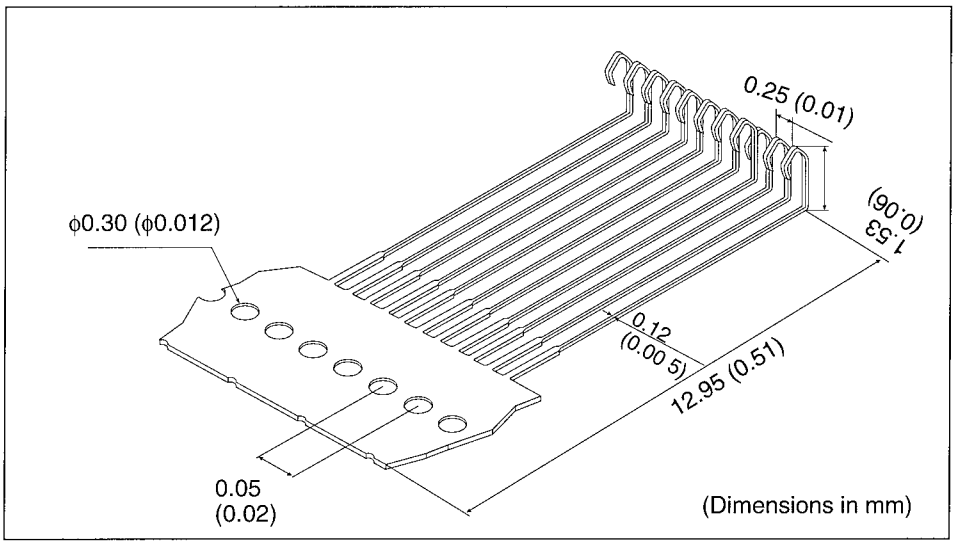
* ***Suzuki Seisakusho Co., Ltd.***
1-255, Aoki, Kuroiso City, Tochigi Pref, 325-0103
Tel: +81-287-63-8311
Fax: +81-287-63-8369

98-08-002-03

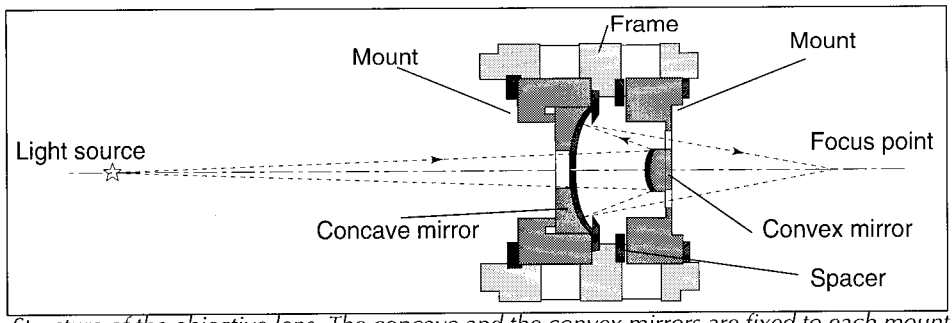
Focusing Lens for Extreme Ultraviolet Rays

Olympus Optical Co., Ltd. has developed a focusing lens for extreme ultraviolet rays using highly accurate and precise techniques. The focusing lens is a reflective optical system which consist of concave and convex mirrors fabricated with a surface roughness of 0.3 nm and figure error within 20 nm. The surface is coated with silicon molybdenum multilayers and the focusing lens has a spatial resolution of 50 nm at a wavelength of 14 nm.

Light rays with a wavelength region between 0.2 to 200 nm are called extreme ultraviolet rays and strongly interact with materials in a particular quantum condition, so various information concerning detailed chemical states as well as structures of materials can be obtained. In ad-



Outline of a connector samples

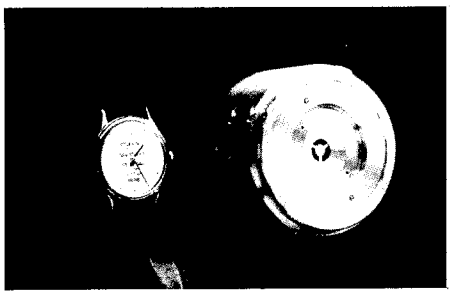


Structure of the objective lens. The concave and the convex mirrors are fixed to each mount with a soft adhesive. Each mirror can be shifted slightly in the direction perendicular to the optical axis for an alignment by pushing each mount through the holes made in the frame. The spacing of the two mirrors is fixed with a thin spacer.

dition, extreme ultraviolet rays have a much shorter wavelength than visible light, thus the diffraction limit (the minimum size of a reduction light beam) of the extreme ultraviolet rays is much smaller. Therefore, the newly developed focusing lens for extreme ultraviolet ray can to acquire abundant knowledge relating to materials with a high spatial resolution.

In general, refractive indexes of all material become nearly 1 in a wavelength region of extreme ultraviolet rays. Consequently, physical phenomena such as refraction and reflection do not occur and it is impossible to focus the rays by conventional visible optical elements. However, the mirror surfaces of the newly developed focusing lens are coated with thin alternate layers of silicon and moybdenum, so the extreme ultraviolet rays can be reflected with a high efficiency due to the interference effect on the mirror surfaces.

Applying this technique, the extreme ultraviolet rays can be focused. In addition, a high precision alignment technique allowed adjustment of the concave and convex mirrors with accuracy better than 300 nm and Olympus succeeded in eliminating aberrations of the lens completely. Thus, the focusing lens has 10 times higher spatial resolution that of the conventional visible optics. Furthermore, the lens system can be designed in a compact cylindrical shape with a diameter of 6 cm and length of 4 cm despite having an extremely high magnification of 224 times.



The two mirrors are included in the single frame to complete the alignment within the objective. 3 spokes supporting the convex mirror can be seen.

* ***Olympus Optical Co., Ltd.***
3-4, Surugadai, Kanda, Chiyoda-ku, Tokyo 101-0062
Tel: +81-3-3251-9880
Fax: +81-3-3251-8946

98-08-002-04

Ultraprecision Time Stabilization Femtosec and Laser Oscillator Indispensable for Generating Femtosec X-Ray Pulse

The Femtosec and Technology Research Association (FESTA) has succeeded in establishing a technology to fabricate an ultrahigh-speed repetitive laser oscillator with a time stability in the domain of less than 100 femtosec. This laser beam is an indispensable technology for generating femtosec X-ray pulses with stability through interaction of an electron pulse and a laser beam, and features a stability not attained previously with laser systems which attempted time synchronization with respect to electron beam accelerators.

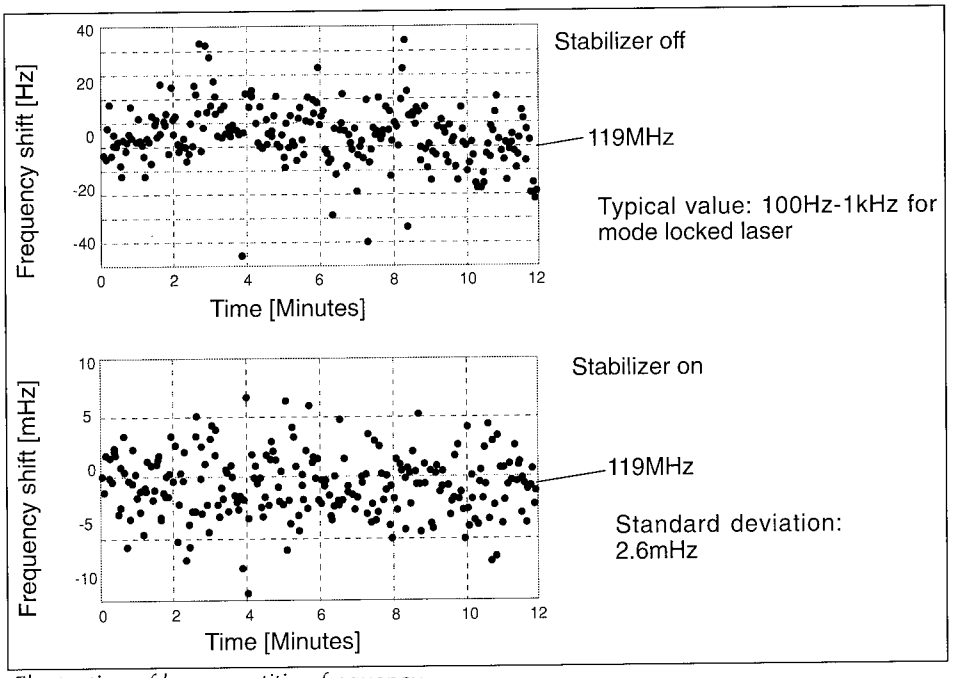
This technology had been under development by the FESTA laser measurement technology research team together with the Electrotechnical Laboratory based on the Industrial Science and Technology R&D Program of the Agency of Industrial Science & Technology of the Ministry of International Trade and Industry and under consignment by the New Energy and Industrial Technology R&D Organization (NEDO).

The regular inspections of the turbines used in power stations and other facilities to confirm their safety involves huge costs. Identification of the ultrafine cracks which cause turbine blade destruction during turbine operation would reduce the costs enormously. For this, an X-ray beam of high energy level and excellent directivity is necessary, and the use of a femtosec X-ray pulse would be ideal that features a high peak strength for discrimination between surrounding noise and signals, and excellent repetitivity of low mean intensity.

Previously, X-ray and gamma beams have been used to confirm the behaviors of electron beams by the inverse Compton scattering method. More recently, in concert with the increased intensities of laser beams, X-ray beams have been used for various types of measurements. Accurate repetitive bombardment of the laser beam and the electron beam is a basic requirement, for which time stabilization of the light beam will be the basic requirement. With a laser beam, prior to amplifying the energy, the seed light is obtained by high-speed repetition of the pulse width of about 100 femtosec by the method of mode locking of a solid-state laser beam such as a titanium-sapphire laser beam. One among these seed lights is selected enabling repetitive amplification. A seed light that is unstable timewise will eventually cause a state not synchronized with the electron beam.

The time of pulse repetition of a mode locked laser beam will be determined by the time required for the laser beam to go to and come back from an optical resonator. Therefore, the repetitive time will fluctuate depending on the elongation of the resonator due to thermal expansion, oscillation of the air or the vibration of the mirror comprising the resonator. The pulse time interval of an ordinary non-stabilized mode locked laser beam will be about 10 ns, and a fluctuation of about a few picosec will occur in this interval. Through research conducted so far, it has become possible to eliminate the causes and to reduce this time fluctuation to less than 100 femtosec.

A titanium-sapphire mode locked laser system was installed in an environment in which vibrations and temperature changes were suppressed rigidly, and a totally solid-state laser beam was used for exciting the



Fluctuation of laser repetition frequency

laser crystal with fully stabilized power fluctuation. Oscillation will occur even if all means are adopted to eliminate the external causes of oscillation, so one of the mirrors was made movable to counteract these oscillations, and a system was adopted for resonator alignment of which the stability was confirmed theoretically with respect to external oscillations. Corrections were made by using a piezo element of rapid response to cope with fast fluctuations caused by vibrations, also by using a motor-controlled oscillation-resistant stage to cope with fluctuations caused by thermal expansion. The repetitive frequency of this mode locked laser beam was set at 119 MHz that is used as the master frequency of the standard frequency of the accelerator high-frequency electric field . Individual techniques have been tried out before, but this time they were studied in an overall balance and integrated for the maxumum stability and practicality.

It will be essential to eliminate any instability when amplifying the seed light obtained from the high-accuracy time stabilized laser beam developed this time, so the further research will minimize the fluctuation when engaging in amplification.

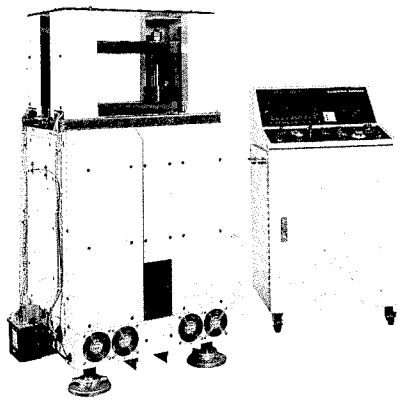
* ***The Femtosec and Technology Research Association (FESTA)***
5-5, Tokodai, Tsukuba City, Ibaraki Pref. 300-2635
Tel: +81-298-47-5181
Fax: +81-298-47-4417

Machinery & Mechatronics

98-08-003-01

Linear Motor Press with BDC Positioning Accuracy Below 5 Micrometers

Yamada Dobby Co., Ltd. has developed a smaller motor applied press and achieved the bottom dead center (BDC) positioning accuracy of below 5 μm for the first time in the world. This development was consigned from the Materials Process Technology Center, and R&D conducted with the cooperation of Fanuc Ltd., and under guidance from Prof. Nakagawa of Tokyo University. The newly developed press is equipped with a magnet at the driving part of the processing head, and surrounded on the driving parts by linear motor coils. The press is operated by the charging the electricity current into the linear motor coil. By changing the value of NC setting, the rotation of head angle and power adjustment are easily changeable by control of the current. The motion of head is usually slipped at the preset point by the change of temperature and secular change, but this press incorporates a sensor for the degree of slip of the head, and the sensed information is fedback for head control. As a result, the positioning accuracy of newly developed press at the BDC achieved the top level of 5 mm. This press requires no crankshaft, so the press can be operated under constant forces where the head is positioned, and achieves silent operation. The linear motor driving part is



installed under the working table for easy maintenance and no lubricants contaminate the pressed products. The specifications of newly developed press are as follows.

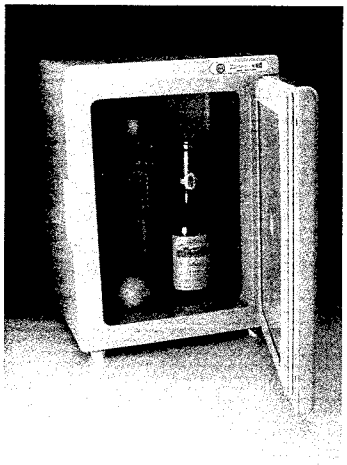
Capacity: 24 Newton
Stroke length: 5 stages with 10, 15, 20, 25, 30, 35 mm,
No. of strokes: 30 to 100 spm (at present), slidelift volume: 30 mm, effective mold dimension: 400 mm × 300 mm, weight: 1,500 kg.

* ***Yamada Dobby Co., Ltd.***
Head Office, Planning Sec.
35, Shimoshinden, Tamano, Bisai City, Aichi Pref. 494-8511
Tel: +81-586-69-5551
Fax: +81-586-69-3895

98-08-003-02

Low Power Consumption Fluon-free Refrigerator

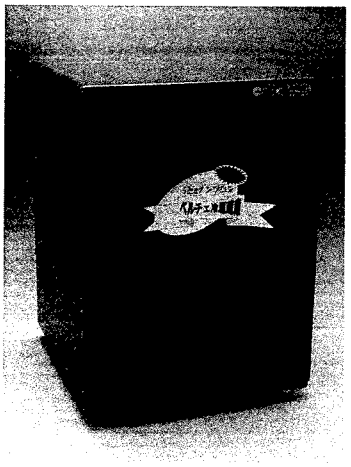
Eco21, Inc. has developed a new type of refrigerator requiring no fluon gas including fluon alternative gases, which uses the Peltier element, a semiconductor device, as the cooling unit. The Peltier element has a heat absorption effect on the conjunction parts of the elements when charging current, so provides cooling directly from electric energy without using fluon medium. By using this phenomenon,



Eco-Peltier refrigerator

Specifications of the Eco-Peltier refrigerator

1.Capacity: 17 liters
2. Dimensions: 330 (W) × 370 (D) × 450 (H) mm
3. Weight: 10 kg
4. Temperature: 5 °C (inside/25 °C outside)
5. Power consumption: 14 kWh/month
6. Cooling system: Peltier cooling system
7. Thermal insulator: polyurethane formed by water
8. Uniform temperature, keeping humidity, etc.



Eco-Peltier cooling system

Specifications of the hot & cool cabinet with eco-Peltier cooling system

1. Capacity: 17 liters
2. Dimensions: 330 (W) × 370 (D) × 450 (H) mm
3. Weight: 10 kg
4. Temperature: 5 °C at 25 °C ambient (60 °C at 10 °C ambient: hot mode)
5. Power consumption: 14 kWh/month (as a fridge)
6. Cooling system: Peltier cooling system
7. Method: Cooling by Peltier and warming by electric heater: polyurethane formed by
8. Thermal insulation: foamed urethane.

the company has developed two types of products, the Eco-Peltier refrigerator, and hot & cool cabinet with eco-Peltier cooling systems.

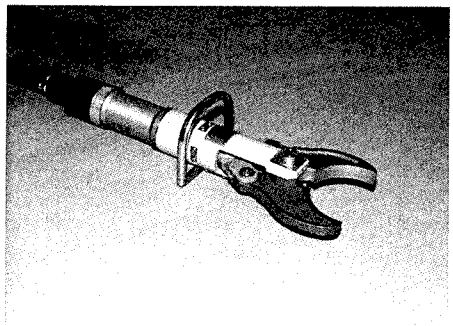
* ***Eco21, Inc.***
1-7-7, Shiohama, Kawasaki-ku, Kawasaki City, Kanagawa Pref. 210-0826
Tel: +81-44-277-5155
Fax: +81-44-277-5616

98-08-003-03

Country's First Rescue Cutter

The Hyogo Prefectural Institute of Industrial Research and Marol Co., Ltd. have jointly developed the country's first rescue cutter for use to rescue persons trapped inside traffic accident automobiles or inside collapsed houses when some disaster occurs.

In the Hanshin-Awaji Earthquake Disaster, rescue work was advanced by using rescue tools to widen the gaps between collapsed housing pillars and walls as well as to cut steel reinforced concrete and beams. Also, to cope with increasing traffic accidents, rescue tools such as spreaders and cutters are used to widen the gaps between doors and to cut car body members.



Country first rescue cutter

However, these rescue tools are mostly equipment manufactured in Europe and the United States. Therefore, much difficulty is being encountered to meet the needs for maintenance and for improvements requested by rescue members. Therefore, the Hyogo Prefectural Institute of Industrial Research had been engaged in the experimental fabrication of a high-performance experimental rescue cutter, and succeeded in commercializing the country's first full-scale rescue cutter through joint research with Marol Co., Ltd. that is known for its preeminent high-performance hydraulic cylinder manufacturing technology.

The newly developed rescue cutter is 723 mm long, weighs 14 kg and its maximum cutting capability is 20 t. The company plans further research to reduce the cutter weight.

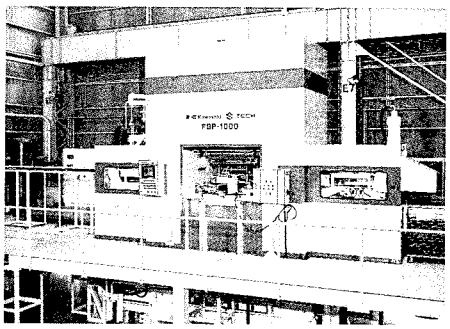
* ***The Hyogo Prefectural Institute of Industrial Research and Marol Co., Ltd.***
240-1, Aza-fuke, Hirata, Miki City, Hyogo Pref. 673-0405
Tel: +81-794-82-0026
Fax: +81-794-83-6230

98-08-003-04

High-Performance Fine-Blanking Hydraulic Press

Kawasaki Hydromechanics Corp. has investigated the substantial cost reduction possible by switching from conventional machining methods to the complex machining method, and succeeded in developing an advanced 1,000-t fine-blanking hydraulic press which incorporates the optimum progressive blanking and conforms to the eccentric load resistance requirement, and clears other requirements in the aspects of accuracy, rigidity and performance.

The new hydraulic press introduces the combined long guide of the 8-sided guide



High-performance fine-blanking hydraulic press

Standard specification of fine-blanking press

Main output	10,000 kN
Breakout output	5,000 kN
Counter output	2,500 kN
Daylight (dist. bet. adapter plates)	600 mm
Shut height (dist. bet. adapter plates)	400-500 mm
Table size	1,400 × 1,000 mm
Number of strokes	24-40 spm

and the ram in main cylinder, and its accuracy and rigidity have been improved though an increase of the eccentric load resistance to uplevel its performance and efficiency in the complex machining of automotive parts. In addition, the system installation space has been decreased by about 30%.

Recently, three-dimensional plastic machining has been introduced, consisting of a mix of cold forging, drawing, doweling and burring for the reduction of machining processes, number of parts in assemblage and for precision punching. The new hydraulic press is designed to respond to these needs.

The table size is 1,400 × 1,000 mm, the number of strokes 24-40/min, and its manipulation panel is based on the fingertip touch design and the display uses the English, Korean and Chinese languages as well as Japanese. The press is marketed at a domestic price of several hundred million yen depending on its specifications, and accessories.

As an option, a peripheral system has been developed that permits automatic die changing as rapidly as 45 s. Prior to the system marketing, the company installed a 1,000-t demonstration system in its research building in Akashi City. The company is engaged in technology development for fine-blanking machining with the cooperation of S.Tech Co., Ltd., a die manufacturer operating in Hamamatsu City, Shizuoka Prefecture.

* ***Kawasaki Hydromechanics Corporation***
15-1, Minami Futami, Futami-cho, Akashi City, Hyogo Pref. 674-0093
Tel: +81-78-941-3311
Fax: +81-78-941-3340

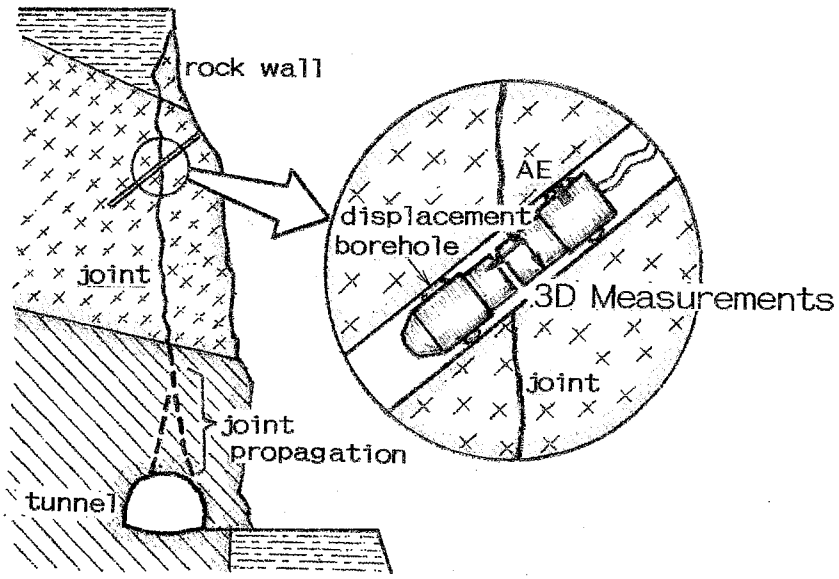
Information & Communications

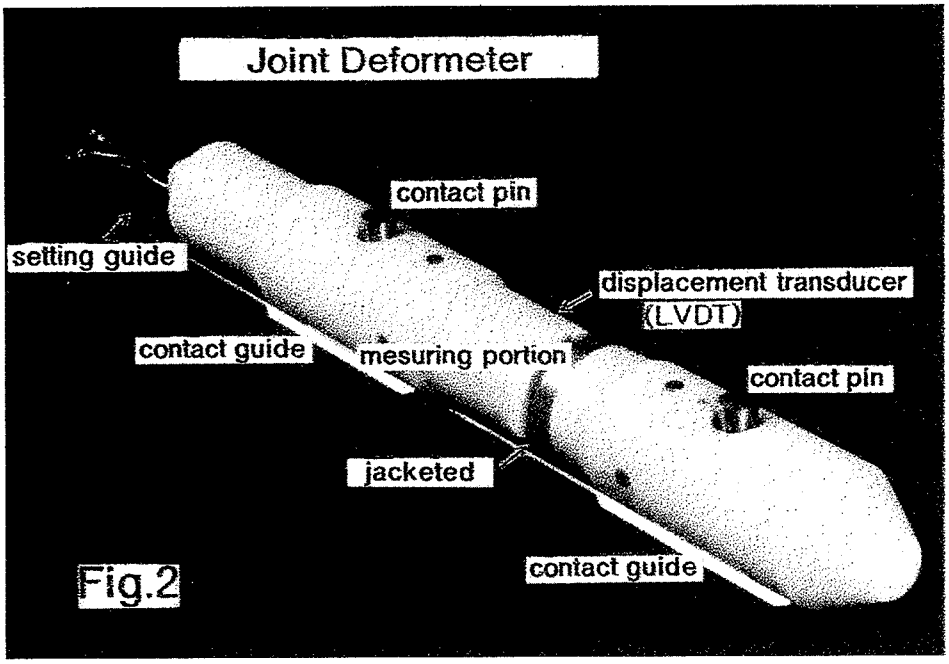
98-08-004-01

New Joint Deformeter

National Institute for Resources and Environment, MITI has developed a joint deformeter and high-accuracy extensometer for field application. Rock mass is regarded as a material orginally having dynamic defects, i.e., various discontinuities such as minor cracks, joints and large faults. Before an underground cavern is developed, rock mass remains stable due to the compressive stress field deriving from its overburden, however, when a part of the rock mass is lost by the excavation of a cavern, excessive loads apply to the remaining part, and strain results. Such deformation naturally appears more in the defect part than in the intact part of the rock mass, and forms a problem of dynamic stability. As to the changes in the ground water flow accompanied by the development of underground cavern, the flow inside of cracks is also greater than the seepage flow inside rock material, therefore, the change in rock mass permeability caused by the behaviour of discontinuity forms an important problem in terms of hydraulics.Therefore, consideration of various problems of underground carvern development, dynamic or hydraulic examinations must incorporatethe discontinuity.

The first step for this research and development is to assess the behaviours as phenomena. The deformation of rock mass is usually measured in boreholes. An accurate behaviour evaluation of a discontinuity existing in random directions cannot be expected unless 3-D measurement is provided. The Joint Deformeter has solved this problem for the first time. This deformeter has a structure which takes measurements of 3-dimensional relative positional changes between two rock blocks separated by a joint. The deformeter is basically composed of two parts: The fixed part including three measured plates at right-angles, and the measuring part including linear variable differential transformers (LVDTs) in three directions. Both parts are settled by mechanical contact pins in a monitoring site.





Measured displacements gives shear displacements on a discontinuity plane and a normal displacement, i.e., opening or closure, of a discontinuity by coordinate transformation. This deformeter permits measurements in a range from 0 to 5 mm with a linearity within a standard deviation of 0.8%. No special contrivance is necessary for the device to monitor static behaviours for a long time, including its installation into underground water.

Essentially, the new deformeter utilizes the behavioral phenomena measured inside rockbeds, such as the cracks, joints and faults which are the causes of major destruction and collapse, from which the degree of hazard of these rockbeds can be assessed directly. Also, the precursory detection of feeble rockbed destructions and plastic deformations which may evolve into rapid and major slide collapse enables the deformeter to be utilized for accurate engineering evaluations and predictions.

The deformeter's wide use will be promoted by use in data accumulation and taking the acquired information on hazardous cracking into account when engaging in tunneling projects. The equipment is also to be used as a risk evaluation tool by directly monitoring hazardous rock cracks occurring in rockbed slopes. A new company has already been established for the deformeter.

* *National Institute for Resources and Environment, MITI*
16-3, Onogawa, Tsukuba City, Ibaraki Pref. 305-8569
Tel: +81-298-58-8111
Fax: +81-298-58-8119

98-08-004-02

Large Size Active Matrix FPD

EIZO Corp. has developed a 18.1 inch (46 cm) active matrix flat panel display (L66). The large screen size, compact design, and low power consumption make the L66 the ideal LCD for banks, trading rooms, and stock bourses.

For adaptability to a variety of user environments, EIZO designed two versions of the L66. The first is a desktop stand type with the power supply unit internally incorporated to increase work space. The second option is a free mount type where the panel can be attached to an arm or hung on a wall to give the L66 increased flexibility in configuration. Other special features include a USB hub on the back of the stand (desktop stand type only), a protective panel to protect the LCD surface from damage, and a speaker unit to enhance multimedia applications. The protective panel and the speaker unit will be sold separately.

The L66 utilizes EIZO's original D3 technology to allow for an image that is free from distortion, mis-convergence, and blurred focus, while greatly improving the control of the brightness level and color

Large size active matrix flat panel display (L66)

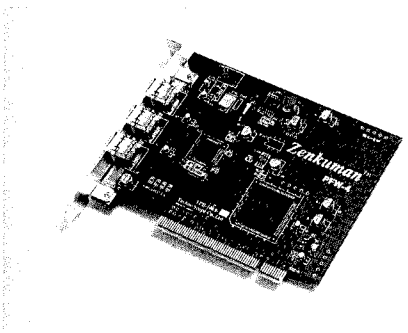
reproduction. The L66 supports a resolution of 1280 × 1024 at the high refresh rate of 75 Hz and has a dot pitch of 0.28 mm. Power consumption is mere 48 W when in regular use and less than 3 W in Power Save mode.

* ***EIZO Corporation***
655, Fukudome, Matto City, Ishikawa Pref. 924-8533
Tel: +81-76-277-3310
Fax: +81-76-277-3450

98-08-004-03

400 Mbit-Compatible Host Adapter Card

Techno Scope Co., Ltd. has developed a host adapter card PFW-4 that is compatible with IEEE 1394 interface 400 Mbps (megabit/s) adopted in home electric and electronic appliances, personal computer and peripheral equipment as a next-generation version digital equipment linkage cable. This host adapter card features a doubly fast image transmission speed compared with existing 200 Mbps-compatible host adapter cards and its price is about the same, so inquiries are pouring in from camera and printer manufacturers.

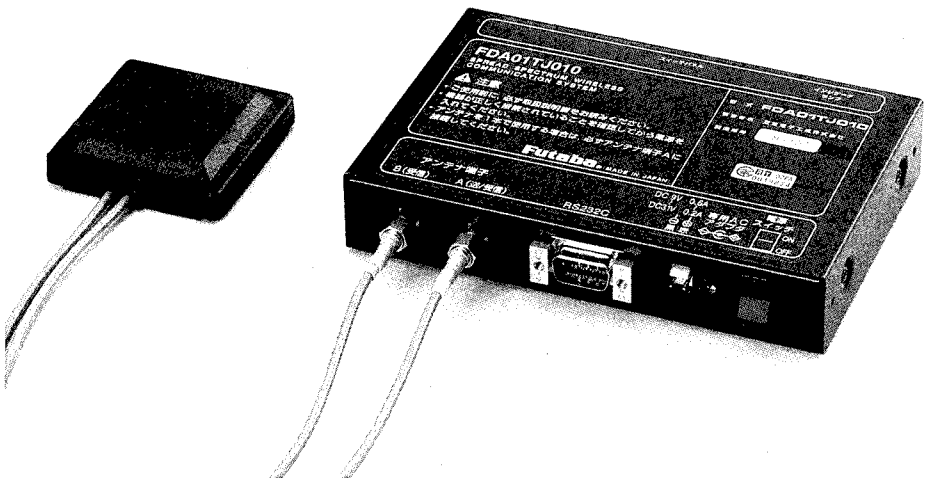


400 Mbit-compatible host adapter card

The company is already marketing an IEEE 1394 interface 200 Mbps-compatible card PFW-21 that is used in Sony Corp. digital cameras. However, users are dissatisfied with the 200 Mbps-compatible card having the same image transmission speed as existing cables, and are making various attempts to increase the transmission speed.

The newly marketed PFW-4 Card has a fast transmission speed and is also designed to draw out the excellent qualities of the IEEE 1394 interface. Its selling price is as yet undecided but is expected to be about the same as that of the existing PFW-21. It will be used on general sale this autumn.

* ***Techno Scope Co., Ltd.***
7-6-13, Kishimachi, Urawa City, Saitama Pref. 366-0012
Fax: +81-48-822-5285
E-mail: webmastar@technoscope.co.jp



New spectrum spreading type wireless unit for 2.4-GHz band

98-08-004-04

New Spectrum Spreading Type Wireless Unit for 2.4-GHz Band

Futaba Corp. has developed a new type of radio communications unit that is a power conservation type 2.4-GHz band spectrum-spreading (SS) system for long-distance data transmission.

The new unit introduces a DS/FH hybrid system consisting of an SS type direct spreading (DS) unit and a frequency hopping (FH) unit for the realization of high-speed, high-reliability transmission, by which a transmission distance that is four times that of the conventional type of FRH series systems has been realized. It displays an outdoor line-of-sight communications of over 1.2 km and has a special-purpose reception antenna, so using a high-gain antenna specifically for reception enables communications over a distance of over 5 km.

The new radio communications unit also features a reception diversity function and can automatically select an antenna of better sensitivity from two antennas which are being used. In addition, due to the frequency diversity effect provided by frequency hopping (FH), it features better characteristics with respect to multipass. It incorporates ten patterns for frequency hopping which permit the establishment

Main Specifications

# FireWire (Trademark)/IEEE 1394 Interface Unit	
	High-speed 100 M, 200 M and 400 Mbps transfer possible Asynchronous and Isochronous transfer support Isochronous cycle master function support equipped with 3 ts
# PCI Interface Unit	
	PCI Short Card (5 V, 32-bit) compatible PCI Local Bus Rev2.1 compatible PCI Bus Master function support PCI Bus DMA transfer function support

Main Specifications

1. Technical standards	RCR Standard Specifications, STD-33A Radio Facility Compatibility Certificate
2. Communications system	Spectrum spreading (SS) system
3. Transmission system	DS/FH hybrid system
4. Hopping pattern	10 channels
5. Data modulation speed	51.9 kbps
6. Aerial power	Up to 10 mW/MHz (180 mW peak)
7. Reach distance	Indoors over 240 m, outdoors over 1,200 m (antenna line-of-sight)
8. Communications mode	1:1, 1: n, n:m
9. Error correction function	Automatic error detection and automatic retransmission function
10. External interface	RS-232C, D-Sub9Pin
11. Data rate	300 bps - 38.4 kbps (wired section)
12. Power voltage	DC 9V - 31 V
13. Current consumption	Normally 400 mA (at time of DC 12 V) Under power conservation 120 mA (at time of DC 12 V)
14. Temperature conditions	Working temp. range -10 to +50 °C
15. Outside dimensions	145(W) × 94(D) × 27(H) mm
16. Weight	300 g approx.

of multiple systems within the same area, and is also compatible with the FRH series systems. The new unit is ideal for use in the monitoring of meteorological and civil engineering measurement data of remote regions, also for telemetering and for telecontrolling.

* ***Futaba Corporation***
1-3, Nakase, Mihama, Chiba City, Chiba Pref. 261-8555
Tel: +81-43-296-5127
Fax: +81-43-296-5124

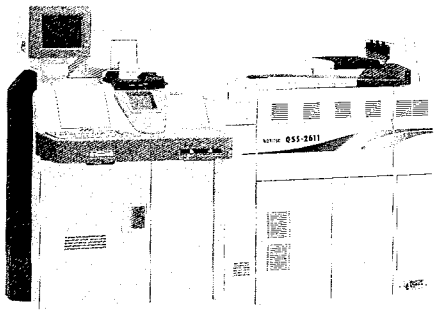
98-08-004-05

Compact and High Performance Minilab

Noritsu Koki Co., Ltd. has developed a compact, high capacity minilab QSS-2611 with unprecedented cost performance. The minilab can process 996 prints/Hr (89 × 127 mm), and produce prints up to 203 × 305 mm and A4 (210 × 297 mm). The minilab has a footprint of just 1.22m², but has the processing capabilities of much larger machines.

By employing a newly developed digital index printer which utilizes VF (vacuum fluorescent) technology, direct printing onto silver halide paper is possible. In addition to being cost effective, this enables the prints and index print for each order to be produced in a single pass. An automatic one pass system also allows prints from an intermixed 135 F/P film and IX240 C,H,P film to be made in single pass.

The QSS-2611 new digital floppy service function takes images acquired by scanning of 135F or IX240 negatives and transfers them into digital data which is subsequently written onto floppy disks. Even without a digital camera or scanner, photo manipulation and retouching can be achieved with just a personal computer. Image size are approx. VGA (480 × 640). By installing the QSS-Net function, it is possible to perform a variety of functions including remote data maintenance, remote version upgrade, e-mail etc.



Compact and high performance minilab

The QSS-2611 provides a range of increased business opportunities and will be marketed to general photo and DP stores, as well as chain supermarkets, drugstores, book stores etc.

* ***Noritsu Koki Co., Ltd.***
579-1 Umehara, Wakayama City, Wakayama Pref. 640-8550
Tel: +81-734-54-0345
Fax: +81-734-54-0301

Specifications

Processable film formats		135 (F/P/H), IX240, 110,126,120
Print sizes	Paper width: Feed length: Max. Print size:	82.5 × 210 mm 117 to 305 mm 8 to 12 inches (203 × 305mm), A4
Estimated processing capacity	135F/24exp 135F/24exp IX240/25exp intermixed negative C(89 × 127 mm), H(89 × 152 mm), P (89 × 254 mm): 688 prints/hr	89 × 127 mm: 986 prints/hr 102 × 152mm:840 prints/hr
Dimensions	W: 760 mm × L: 1850 mm × H: 1306 mm	
Weight, approx	385kg (body) + 124g (solutions) = 509kg	

Process & Production Engineering

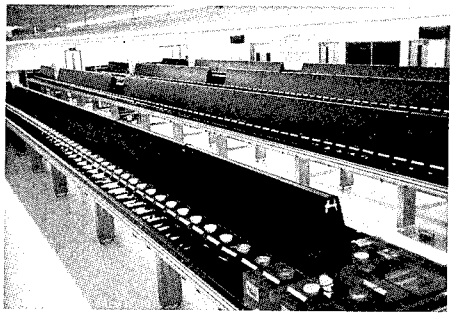
98-08-005-01

System for Automation of Green Tea Transaction Centers

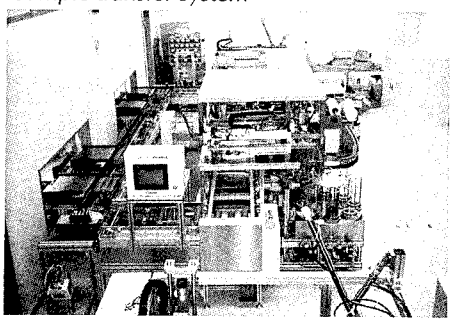
Mayekawa Mfg. Co., Ltd. has developed a system for automating green tea transaction centers and has delivered the first system to the Kagoshima Green Tea Distribution Center at a domestic price of ¥185 million.

Up till now, green tea transaction centers had been rather backward in automation for labor conservation and speedup of operations, so that information processing in connection with tendering operations had been quite complicated and required much time at transaction centers and offices. Purchasers had to walk around for hours in the transaction centers and offices to examine the green tea samples, and much labor was involved in the delicate tasks of sample assessment, so the transactions tended to be unstable and unfair.

The new system for green tea transaction automation has eliminated the complexity and ambiguity in transaction centers by automating the existing tender preparation and implementation operations, creates uniform evaluation conditions for scrutiny by purchasers, and eliminates long tedious examination work, so that the tendering tasks are now accomplished much faster and with less labor than before. The green tea samples and green tea sampling cups are revolved in front of the purchasers on an automatic robotized transfer line on free rollers until the tendering operation is completed. The purchasers can therefore engage in tendering while seated, and a handy terminal held in the hand is used for readout of bar code data affixed on each green tea sample, for recording the purchasing prices and for the transfer of these information.

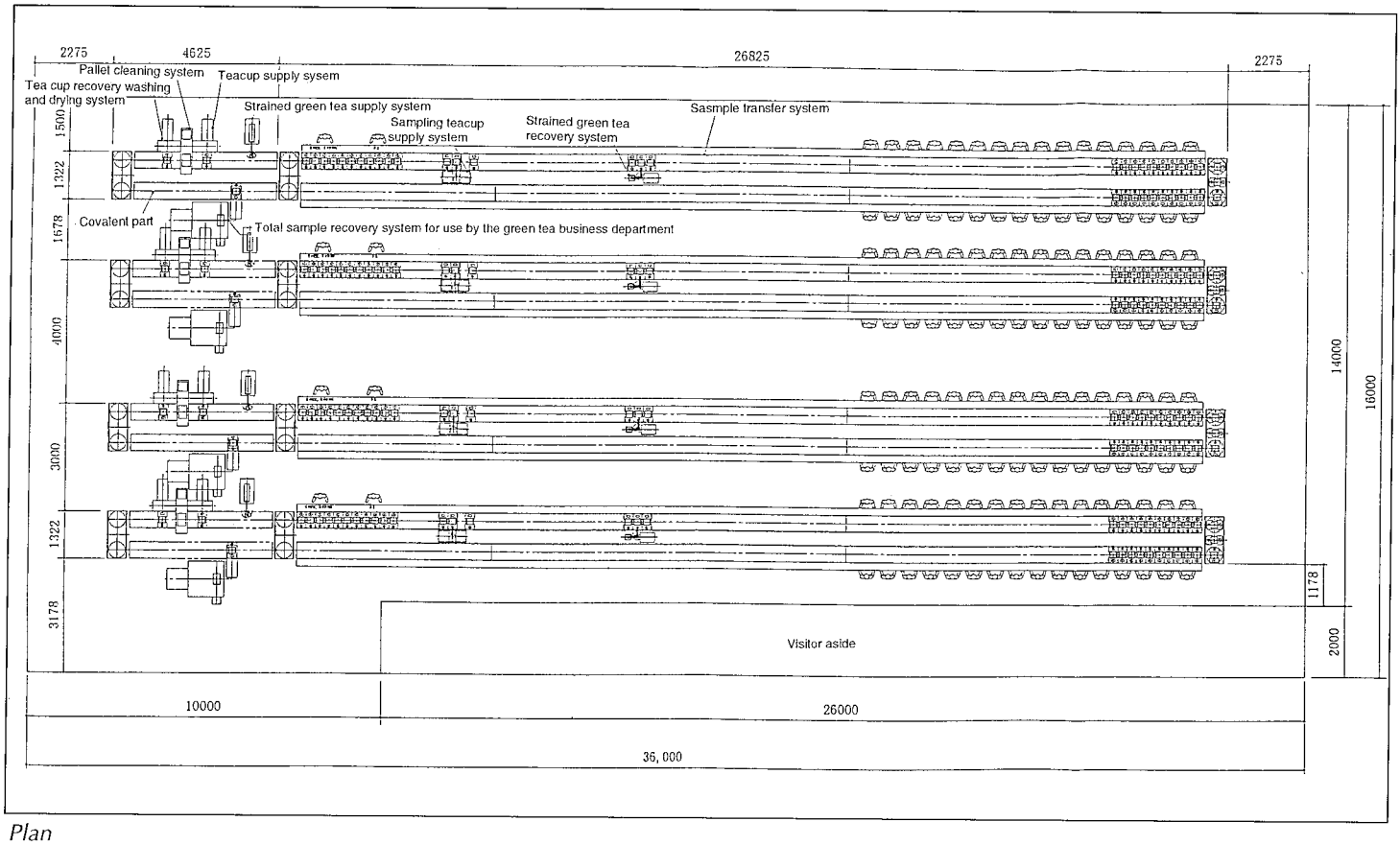


Sample transfer system



Post treatment subsystem

The system consists of a Sample Transfer Subsystem and a Post Treatment Subsystem. The former consists of an automatic green tea supply system, a sample transfer system, a sampling teacup supply system, a strained green tea recovery sys-



Plan

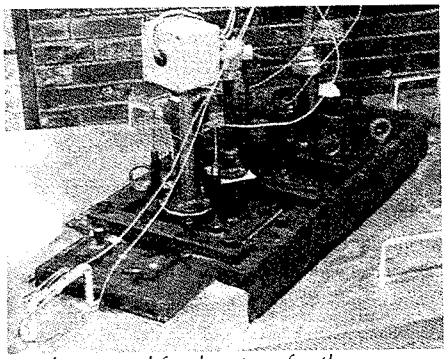
tem and a teacup recovery system. The latter consists of a teacup washing, drying and pallet cleaning system and a total sample recovery system for use by the green tea business department.

* ***Mayekawa Mfg. Co., Ltd.***
Corporate Communications Dept.
2-13-1, Botan, Koto-ku, Tokyo 135-8482
Tel: +81-3-3642-8181
Fax: +81-3-3643-7094

98-08-005-02

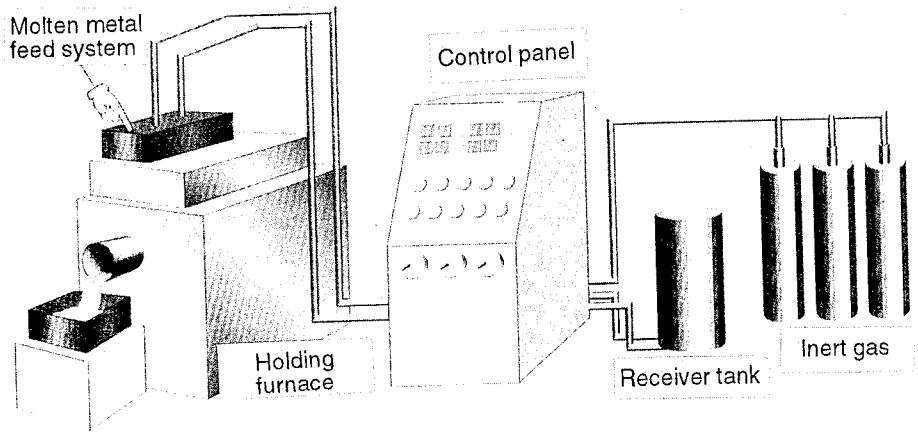
Molten Metal Feed System for Aluminum Casting of Automobile Parts

Ariake Ceraco Co., Ltd. and Toyota Motor Corp. have jointly developed a molten metal feed system for the aluminum casting of automobile parts.



Molten metal feed system for the aluminum casting of automobile parts

Pump pressure control uses an inert gas, and since the system is based on a hermetically sealed construction, the molten metal does not come into contact with the atmosphere air and therefore not deteriorated by oxidation. The system uses no mechanical stopper parts, so is problem-free. The use of an inbuilt heater and a temperature retaining heater enables temperature control with ease, and the simple system construction enables ceramic molding with ease. The system can therefore be used in a wide range of applications from high-accuracy, fixed-volume feeding to simple suction. The molten metal feed rate is up to 50 kg/shot, but will differ with the specific type of system.



Block diagram

The system introduces a pneumatic hermetically sealed pump using inert gas for pouring molten aluminum into the casting molds, which minimizes molten metal loss and product deterioration. The system has been marketed in July this year for use by automotive parts manufacturers as a system ideal for the manufacture of aluminum parts which are anticipated to come into wide use for automobile weight reduction and for promoting raw material recycling.

The system consists of a pump and a holding furnace for the ladle containing the high-temperature liquefied aluminum for pouring into the casting molds.

A loss of 3-5% of molten metal used to occur when pouring molten aluminum into the casting molds by the ladle system or other existing conventional systems, but the new system operated by pneumatic action suppresses the loss to within 1%.

The pump is marketed at a domestic price from ¥ 2 million, and a system consisting of the pump and the heat retention furnace at a price from ¥ 35 million, which are about 20% lower than the prices of conventional counterparts.

* ***Ariake Ceraco Co., Ltd.***
583, Funako, Atsugi City, Kanagawa Pref. 243-0034
Tel: +81-462-28-9215
Fax: +81-462-28-9217

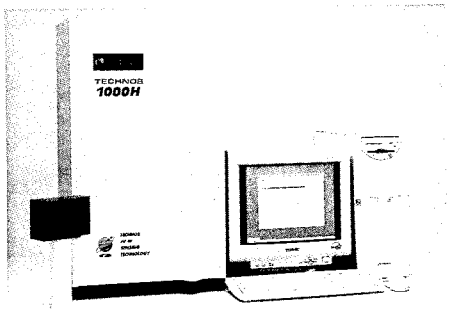
98-08-005-03

Automatic Appearance Inspection System

Technos Japan Corp. has marketed a newly developed Technos Time/Space Sensing 1000 H System that introduces new technology to improve the defect detection accuracy considerably by changing the time axis and the space axis. The newly introduced time/space sensing technology in principle completely eliminates the controversial disparity among pixels.

The clear and detailed data relating to the respective spatial points (areas with longitudinal and horizontal axes) of the target object are read out with the camera in correlation with the direction of the time axis to detect the defects (patents pending). This new technology was realized by developing a new type of simultaneous parallel mutual correlation processor with 5,120 channels. This new inspection system performs processing on the time axis, so can automate the inspection of all types of production lines based on extrusion molding or roll forming. This enables the inspection of all types of products of cylindrical and other complicated shapes with ease.

This new technology was realized by obtaining correlated data which are detected by changing the time factor with the same sensor when reading out a target object with a sensor. Specifically, the pixel information of a 5,120-pixel sensor are recorded in real time, and the correlation is acquired with an instant later of the pixel information. The image is equivalent to performing simultaneous parallel image data processing with a 5,120-channel correlation processor. The new processor developed by Technos allows automatic inspection of correlated values simultaneously with three different processes, de-

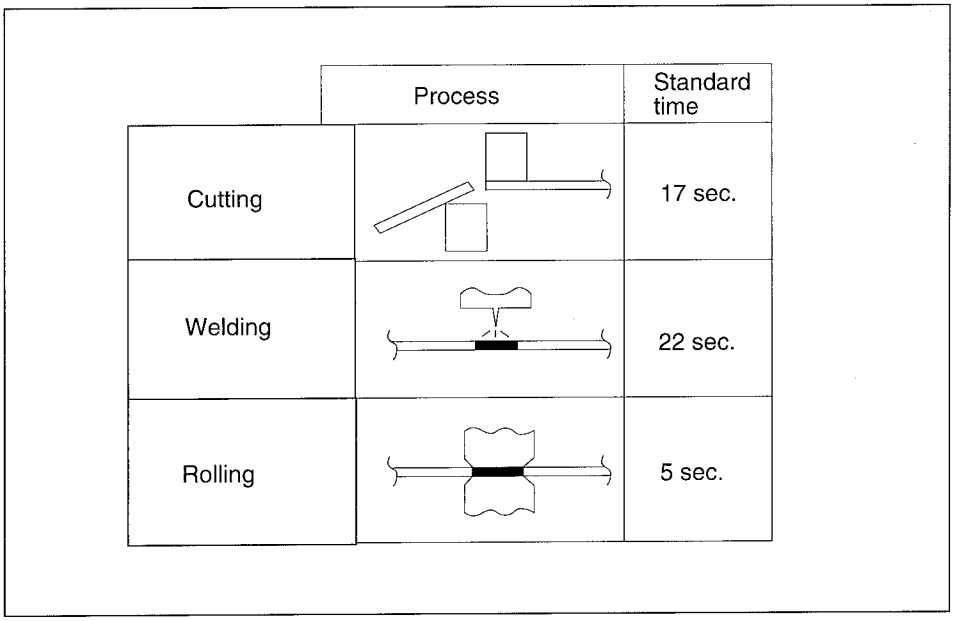


Technos Time/Space Sensing 1000 H System

tecting even the finest flaws as well as the color disparities.

The Technos Time/Space Sensing 1000 H System enables the inspection of targets of all types of shapes with ease, based on the establishment of a time-axis correlation process, by which even the slightest surface damage and other defects of the most complicated stereographical objects extruded from dies are detected. Individual errors are eliminated for stable operation by a correlation process, in addition to featuring maintenance ease, so excellent inspection functions are achieved for a wide range of applications.

* ***Technos Japan Corporation***
General Affairs Dept.
5-26-12, Minami-Ohi, Shinagawa-ku,
Tokyo 140-0013
Tel: +81-3-3767-9111
Fax: +81-3-3554-1231



Process of hoopwelding system

98-08-005-04
Hoopwelding System

Murata Welding Laboratories Inc. has developed a hoop welding system that accurately buttwelds thin-plate (0.1-0.3 mm) coiled materials for lead frames, connectors and batteries, and is a coiled material shearing, welding and rolling system designed to improve the safety and productivity of high-speed press lines.

In the preliminary process of feeding the hoop materials from the uncoiler into the press, the system welds the hoop materials together. The system features compactness and lightness, or can be moved about with ease. It is sold at a domestic price of ¥ 6,500,000.

The buttwelding work is completed within one minute, consisting of 17 s for shearing, 22 s for welding and 5 s for rolling. The workpieces are supplied without stopping the press line, so the line productivity is improved substantially. The system mounts two cylinders for a special type of gas the company developed at the same time, and has a length of 400 mm, width of 800 mm, height of 1,300 mm and weighs 200 kg. Since it can be moved about with ease, it is usable in multiple press lines.

* ***Murata Welding Laboratories Inc.***
4-17-9-1018, Kigawa-Higashi, Yodogawa-ku, Osaka City, Osaka 532-0012
Tel: +81-6-390-6768
Fax: +81-6-390-8474

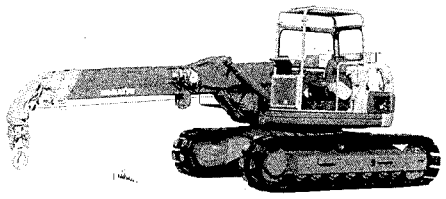
Construction & Transportation

98-08-006-01
Telescopic Type Crawler Crane

Komatsu Ltd. has marketed a newly developed telescopic type crawler crane LC 1285 Underground Specifications Crawler Crane that introduces a low vehicle-height short boom (patents pending) that enables heavy-duty cargo handling in working environments of low ceiling heights and displays a hoisting capacity that is one class higher, especially when operating at worksites where there is a limit in the ceiling height.

The boom-tip buckets have been designed with a new shape and the hooks made smaller, by which the hoisting range has been decreased substantially. In addition, obstructions to operator vision have been eliminated from the right and upper sides of the boom, while the winch wire has been installed on the boom underside to prevent wire damage through contacts with reinforcing steel.

There are frequently limits in the working height and in the lateral latitude at worksites such as in subway construction projects, making safe handling of extra-heavy structural members all the more important. The new crawler crane can handle loads of a maximum rated weight of 3.79 t in working environments with a ceiling height of 5 m, a capacity not displayed by conventional types of comparable crawler cranes, and since its minimum working radius is 3.3 m and rear-end turning radius 1.44 m, it is usable conveniently for engaging in construction work demanding the use of crawler cranes of small turning radius. The new crawler crane is marketed at a domestic price of ¥ 24 million.



1285 Underground Specifications Crawler Crane

* ***Komatsu Ltd.***
Public Relations Advertising Dept.
2-3-6, Akasaka, Minato-ku, Tokyo 107-8414
Tel:+ 81-3-5561-2616
Fax:+ 81-3-3505-9662

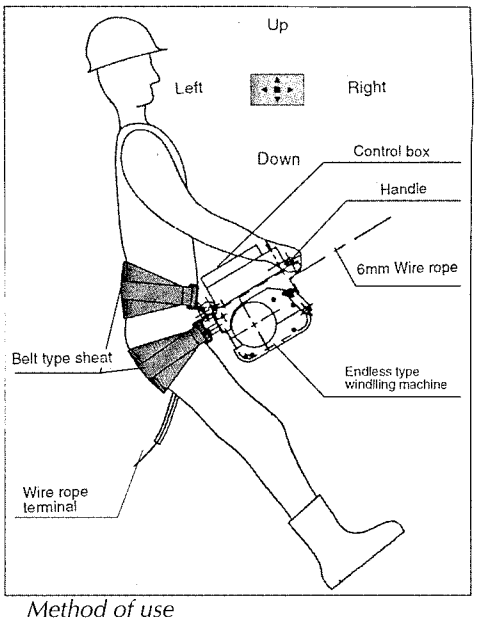
98-08-006-02

Worker Suspension System for Climbing Inclined Planes Freely

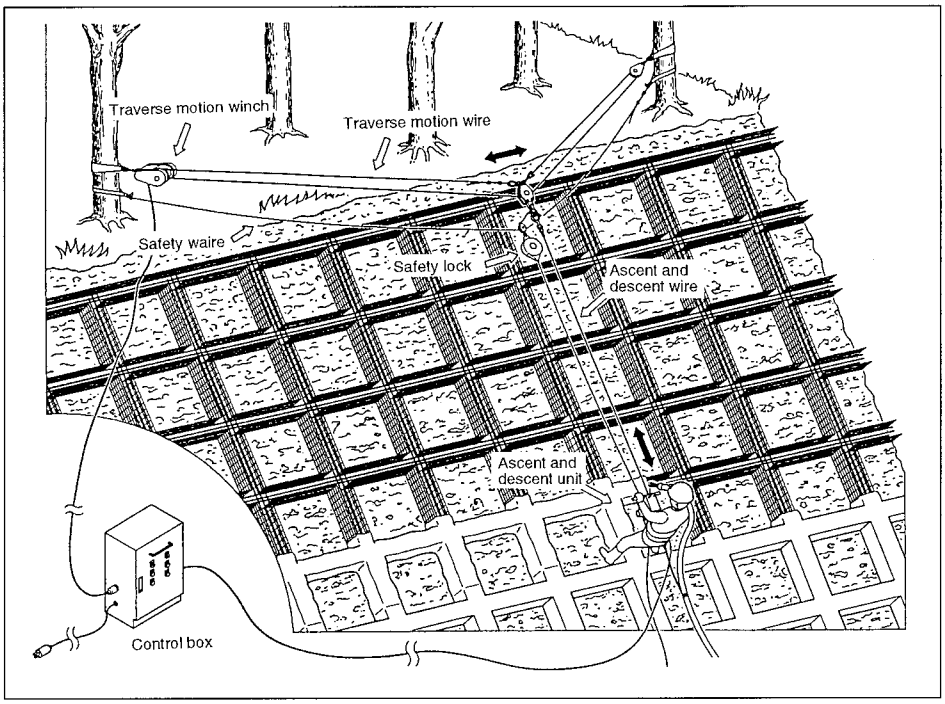
Shimizu Corp., together with Okabe Civil Engineering Co., Ltd. and Japan Biso Co., Ltd., has commercialized a worker suspension system called Noboru-kun (Master Noboru) which enable workers to climb up inclined planes easily and freely. This system provides expanded work space, reduction of labor and securing of safety at job sites in mountainous regions.

This system uses a motor-driven suspension system. Workers can move around on the inclined planes easily by simple switch operation. Compare with the conventional system using a rope, physical effort is not required, so the worker's efficiency is much more improved. This semiautomatic system consists of vertical shift, lateral shift and fall prevention.

For the vertical shift system, a worker carries a small light weight winch (15kg) in front and seats a wire terminal forward and winds up the wire into a winch, while suspending the other wire terminal behind. The worker suspends himself from this winch using a safety belt, and operates manually. The winch is a compact , light-weight, and endless winder type which winds the wire by frictional forces. The best posture of the worker is to lean back , so the worker does not recognize the weight of the winch so much.



Method of use



System assembly

For the lateral shift system, an endless-winder type winch is set on the one upper side of the inclined planes for wiring while a pulley is set to the other end. This provides tension to opposing directions of the main wires for the lateral shift, which reduces the power of the winches and allows use of a thinner lateral shift wire. The lateral shift motion is also operated by the worker in the same manner as the vertical shift.

For the fall prevention system, the safety wire is installed horizontally to the main wire of the lateral shift. The safety lock for the fall prevention is set under the pulley winch shifts on the safety wire and the terminal of the safety wire is attached directly to the worker . The safety of the worker is secured even if the vertical shift wire or the lateral shift wire is broken.

This semiautomatic system is very convenient for reinforcing inclined planes used in land preparation projects in mountainous regions.

The system is available both on sale and on lease through Okabe Civil Engineering. Co., Ltd.

Spraying operation

* ***Okabe Civil Engineering Co., Ltd.***
Public Relations Dept.
3-14-4, Narihira, Sumida-ku, Tokyo 130-0002
Tel: +81-3-3624-5188
Fax: +81-3-3624-5189

Energy & Resources

98-08-007-01

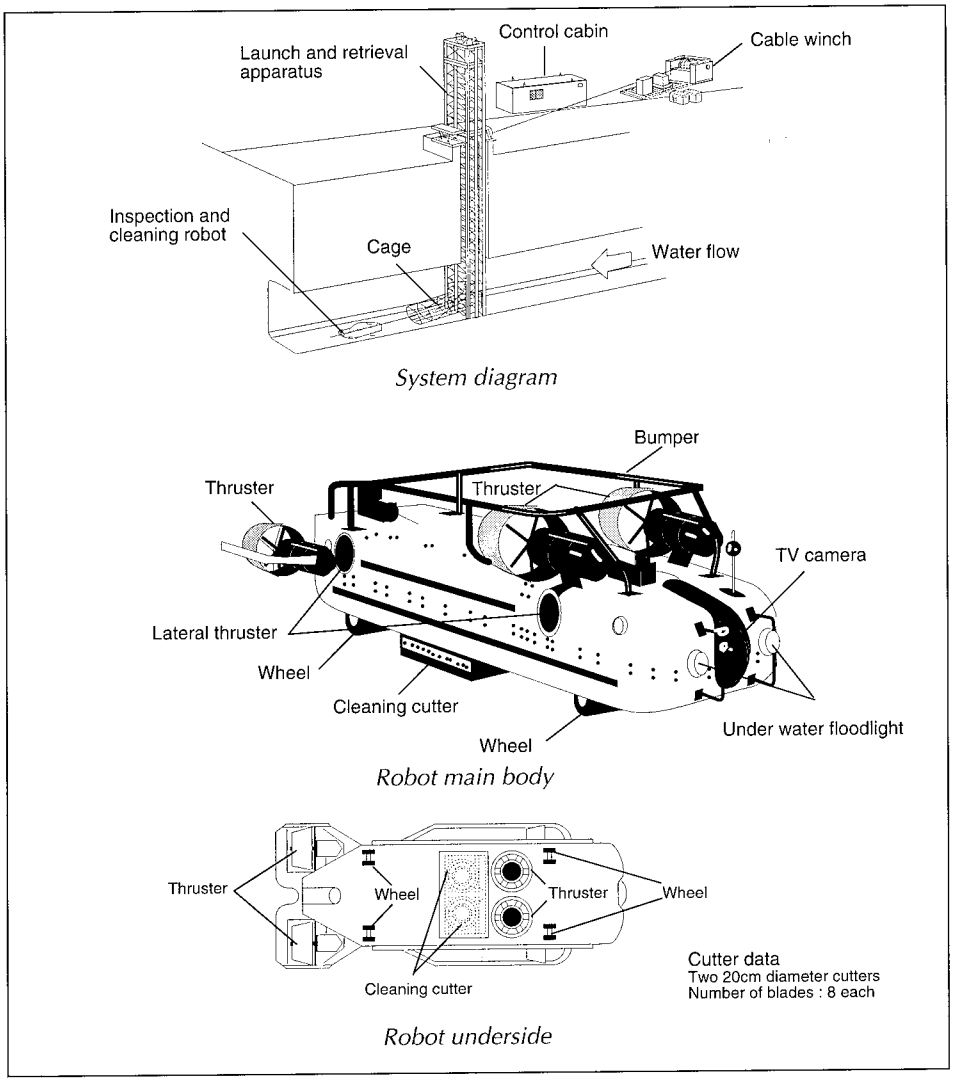
Inspection and Cleaning Robot for Thermal Power Station Water Intake Channel

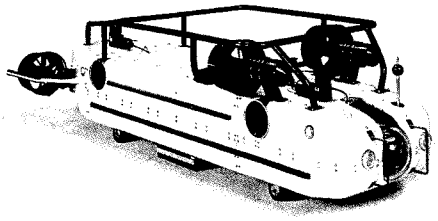
The Chugoku Electric Power Co., Inc. and Mitsui Engineering & Shipbuilding Co., Ltd. have jointly developed an intake channel inspection and cleaning robot that can clean and inspect the water intake channels of thermal power stations while the plants are in operation.

Thermal power stations take in seawater via intake channels, and use it to cool the steam that drives their turbines. Marine growth such as barnacles could adhere to the sides of these channels, impeding the flow of seawater and causing insufficient volume of the cooling water. To prevent this, these channels are periodically cleaned.

At present, such cleaning is performed by human labor during scheduled inspection, and necessitates stopping of power plant operation, and draining of the intake channel.

The newly developed robot is able to perform inspection and cleaning while the plant is in operation, due to its compactness and the innovative drive methods. Thus, its use is unrestricted by considerations of power plant operation, and the automated operation permits quick and efficient cleaning. Accordingly, this robot is expected to make great contributions to lowering generating costs and to reducing maintenance labor.





Channel inspection and cleaning robot

The system is composed of an underwater robot, a cable winch, a launch and retrieval apparatus, and a control cabin. The robot has a width of 90cm, length of 2.6m, height of 75cm, and weights of 300kg. The power voltage is ± 260VDC (for forward and vertical thrusters,) ± 140VDC (for wheels and accessory devices) to operate the 8 thrusters and 4 wheels. The robot is equipped with 2 rotating cutters on underside, for scraping away marine growth, fore and aft underwater floodlights, and onboard TV camera, as well as sonar for sensing obstacles.

The robot is propelled by its thrusters and wheels over the sides and bottom of the water intake channel according to a preprogrammed route. The rotating cleaning cutters on the robot's underside scrape away marine growth such as barnacles, and a suction thruster collects the scraped-away marine growths and deposits them in a receptacle inside the robot body.

The TV images of the situation inside the channel are relayed to the control cabin at the ground surface, enabling personnel in the control cabin to check that cleaning is being performed properly.

The robot is compact and streamlined against water currents. Innovations such as a variety of sensors allow computer control. These features assure operational stability, and enable the robot to perform its operations at a speed of 0.5m per second underwater (with water current speed not exceeding 1.8m per second).

The marine growths scraped away are deposited in the robot, to prevent the otherwise free-floating marine growth from being sucked into the circulation pumps or other equipment and impeding the operation of generating equipment.

When a certain amount of marine growths has been deposited in the basket

inside the robot, the robot returns automatically to the launch/retrieval apparatus to be lifted to the surface, where the basket is replaced. Then the robot returns to the channel to continue working. The automation of this series of operations (marine growth removal, collection and ejection), helps the robot to work quickly and efficiently.

Due to the combined use of thrusters and wheels, the robot is able to clean thoroughly any desired part of the channel including top surfaces and corners.

As the robot operates, the sonar probes for obstacles in its way. If any obstacle is sensed, the robot stops automatically to avoid collision.

* ***Chugoku Electric Power Co., Inc.***
Public Relations Dept.
4-33, Komachi, Naka-ku, Hiroshima City, Hiroshima Pref. 730-0041
Tel: +81-82-241-0211
Fax: +81-82-242-8437

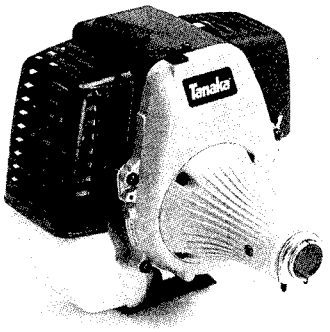
98-08-007-02

New Type of Two-Stroke Engine Eliminates HC and NOx by 70%

Tanaka Kogyo Co., Ltd. has developed a new type two-stroke engine that eliminates the emission of hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxides (NOx) by as much as 70% compared with conventional types of two-stroke engines. The engine has been certified by the California Air Resources Board for its Year 2000 Emission Standard as the first in the world and will be mass produced from September this year.

The two-stroke engine features more excellent characteristics than the four-stroke engine in the aspects of lightness, compactness, larger output and lower manufacturing cost, and in its maneuverability in all directions. By capitalizing on these excellent characteristics, virtually the entire number of two-stroke engines manufactured in the past has been used for producing portable equipment such as brush cutters, chain saws hedge trimmers, and so on.

Basically, its a conventional two-stroke engine with a patent pending design of scavenging ports, piston, cylinder and crankcase to achieve a much more efficient combustion process. During the intake stroke , the fuel-air mixture is forced through extended scavenging passages within the crankcase wall and cylinder to



New type two-stroke engine

achieve a higher level of atomization. As the mixture travels, inertias and centrifugal forces cause creating higher content of the fuel portion of the mixture, which is trapped by unique designed cylinder head and precisely directed to the combustion chamber. The benefit of this whole process is dramatic reduction of unburned fuel leaking from exhaust port and complete combustion.

Another important aspect are that the fuel efficiency is increased by over 30% , yet the production cost increase is minimal.

* ***Tanaka Kogyo Co., Ltd.***
Public Relations Dept.
3-4-29, Tsudanuma, Narashino City, Chiba Pref. 275-0016
Tel: +81-474-72-1111
Fax: +81-474-79-0558

98-08-007-03

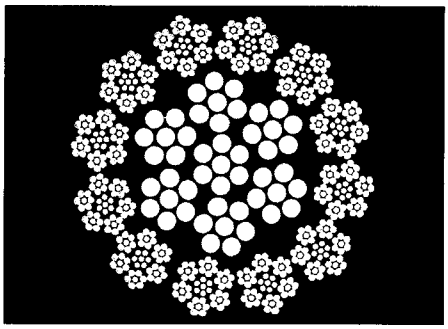
Niobium-Titanium Superconductor with Large AC Current Capacity

Furukawa Electric Co., Ltd. has succeeded for the first time in developing a large-capacity niobium-titanium superconductor that can pass an AC current of 10 kA (effective value) in a 50-Hz AC magnetic field of 0.5 T (peak value). This research project was advanced as a link of the New Sunshine Program of the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry under consignment by the New Energy and Industrial Technology Development Organization (NEDO) as a Superconducting Power Generation-Related Equipment and Material Technology R&D Organization (Super-GM) research theme.

Existing power systems are generally based on handling AC power of 50 or 60 Hz, and the development of AC superconducting equipment is indispensable for the commercialization of superconducting equipment. However, the superconducting phenomenon enables DC current passage without generating any loss (heat generation) in a state of complete zero electric resistance with respect to DC current, but AC loss generates heat with respect to AC current. Therefore, the theme of suppressing the AC loss to minimum, or the development of a large-capacity superconducting wire of minimal AC current loss is the key to the commercialization of AC superconducting equipment.

Using ultrafine superconducting wires in concentration to decrease the AC loss generates drift current and the heat generation phenomenon, so that the current passage capacity is rather decreased, and increasing the current passage capacity had remained as a major theme for research.

The sectional structure of strands and the construction of stranded wires were reassessed, by which current passage up to 10 kA became possible. The newly developed AC conductor primary stranded wire assembly consists of six 0.2-mm diameter superconducting wires stranded on a cupronickel core wire, these wires are stranded with the secondary stranded wire assemblies each consisting of six stranded wires, and twelve of these secondary stranded wire assemblies are stranded together to comprise a three-layered stranded conductor of about 9 mm diameter consisting of a total of 432 superconductors.



Cross section of conductor for AC current of niobium-titanium superconductor

* ***Furukawa Electric Co., Ltd.***
Public and Advertising Div.
2-6-1, Marunouchi, Chiyoda-ku, Tokyo 100-8322
Tel: +81-3-3286-3048
Fax: +81-3-3286-3694

Environment

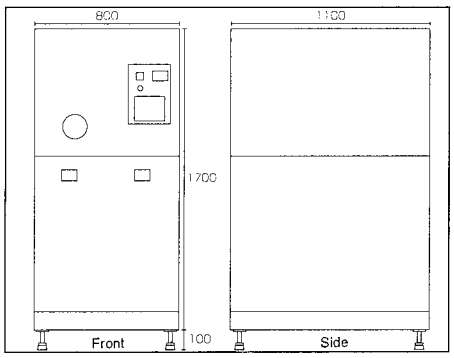
98-08-008-01
Vacuum Distillation/Regeneration System for Recycling of Washing Fluids

Fukui System Co., Ltd. has started marketing a newly developed vacuum distillation/regeneration system FSVD 100 that effectively enables recycling of washing fluids after use to wash the surfaces of silicon wafers which are basic semiconductor wafers. The washing fluid is heated under low pressure in a vacuum state to remove impurities, so the boiling point is low and the fuel cost can be decreased to about one-half compared with conventional types of systems.

The system has a breadth of 80 cm, depth of 110 cm and height of 180 cm. The system automatically removes oils and impurities in the hydrocarbon washing fluid and regenerates the fluid, or maintains the washing fluid cleanliness to a fixed level to stabilize the purity level of the products which are washed, so that the product defect ratio is lowered and the administration of the hydrocarbon washing fluid easened substantially.

This vacuum distillation/regeneration system consists of a vacuum distillation tank that heats, distills and regenerates the hydrocarbon washing fluid including the impurities washed off, an oil tank for heating the distillation tank, and a cooling column to take out the cooled and liquefied washing fluid after it is treated by heating and gasification. The hydrocarbon solution used by the washing fluid normally has a boiling point of about 180 °C, but since distillation is accomplished in a vacuum environment, this is reduced to 80°C, the heat necessary for heating has been suppressed to about one-half. At the same time, the waste heat that was dissipated outside previously is utilized to preheat the washing fluid beforehand to enable quicker attainment of the boiling point, which shorten the heating time.

Due to these improvements, the treatment capacity of the washing fluid has been increased to 60-100 liters/hr compared with that of 40 liters/hr of conventional types of comparable washing fluids.The volume of use of hydrocarbon detergent is also decreased, so the volume of waste hydrocarbon detergent decreased at the same time.



Dimensional drawing

The system piping has also been simplified, so that a system is now available at a price of ¥ 2,600,000, compared with a conventional type of system that costs about ¥ 3 million.

* ***Fukui System Co., Ltd.***
Public Relations Dept.
3-43-3, Ohmachi, Hirohata-ku, Himeji City, Hyogo Pref. 671-1155
Tel: +81-792-36-6935
Fax: +81-792-36-8994

98-08-008-02
Regenerative Type Hydrogen Chloride and Dioxin Adsorption Agent

Keihanna Environment Co., Ltd. and Oax Co., Ltd. have jointly developed a hydrogen chloride and dioxin adsorption agent that can be regenerated and used repeatedly.

Recently, various types of alkali filters have been developed to remove hydrogen chloride and dioxin, but with these filtration systems, the deliquescence phenomenon is caused when hydrogen chloride gas is absorbed to result in filter self-destruction or early saturation to deteriorate the removal efficiency. Therefore, when working with high-density hydrogen chloride and in large-capacity incineration facilities, the method of supplementing with a bag filter system of blowing in activated carbon or slaked lime into the flue is adopted as before.

The newly developed adsorption agent is produced by heating $Mg(OH)_2$ for about one hour at 100-120 °C to alienate hydroxyl, followed by sintering at 830-850 °C. This method enables the sintering of hard $Mg(OH)_2$ of over 90% purity whose sintering had been difficult previously.

When this high-temperature dechlorination agent is used at the outlet of a secondary combustion chamber, the hydrogen chloride combines with magnesium hydroxide $Mg(OH)_2$ ions, is converted into harmless $MgCL_2$ and crystallized in needle form on the adsorbent surface to permit hydrogen chloride removal with ease. Dioxin, an organic chlorine compound, can also be adsorbed effectively with sintered magnesium hydroxide.

The adsorbent, after adsorbing dioxin, can be removed from the combustion furnace surface in crystallized form as harmless $MgCL_2$ in the same manner by filling the demineralizing chamber with water vapor and temporarily creating a reducing environment, then sintering at 400-500 °C. The combustion furnace can be used semipermanently by cleaning regularly in this manner. In general, dioxin is removed from combustion furnaces by using a bag filter, but this involves a huge capital investment. This new adsorption agent is simply used at the outlet of an existing secondary combustion furnace and reduces the installation cost of the treatment system substantially.

When used at near the outlet of a secondary combustion furnace and heated, this high-temperature dechlorination agent displays the effect of decomposing noncombusted carbon, a precursor of dioxin, into carbon gas to prevent the regeneration of dioxin in the secondary combustion furnace and beyond. The two companies used this new hydrogen chloride and dioxin adsorption agent in a newly developed water vapor type gasification furnace, and fully confirmed the considerable effect in the treatment of exhaust gas, especially when waste vinyl chloride plastics exist in a mixture with the waste to be treated.

* *Oax Co., Ltd.*
Public Relations Dept.
1-13-19, Taishi, Ichinomiya City, Aichi Pref. 491-0852
Tel: + 81-586-23-6411
Fax: +81-586-23-6412

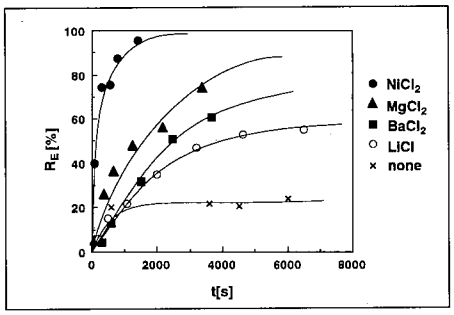
98-08-008-03
Removal of Toxic Organic Compounds from Aqueous Solutions Using Solvent Sublation

Prof. J. Shibata and his research team of the Department of Chemical Engineering, Faculty of Engineering, Kansai University, have confirmed that toxic organic compounds, such as tri-chloroethylene that is regarded as causing cancer, can be removed effectively in large quantities and at low cost. Ultrafine air bubbles are used to recover these ultrafine substances, and it has been confirmed that tri-chloroethylene with a concentration of about 10 ppm can be removed by virtually 100% in an hour.

The solvent sublation technique that was originally proposed by Sebba of the Republic of South Africa. The test is conducted by using a glass column (tube) with a diameter of 50 mm and 440 mm tall. Underground waste water is fed inside from the underside, air supplied through a glass filter provided at the lower part of the column, and the recovery solvent added from the column upper part.

Waste water is fed from the column bottom, and air bubbles of 0.2-mm diameter blown into the column. Then the ultrafine quantities of organic substances are volatized, adhered and adsorbed on the air bubble surfaces, boundary film and further inside the bubbles, and the organic substances separated and collected during transit through the recovery solution at the upper part of the column. Experiments confirmed that these organic substances can be concentrated by as much as 1,000-10,000 times, and as many as twelve different types of organic chloro-compounds have been removed successfully and effectively.

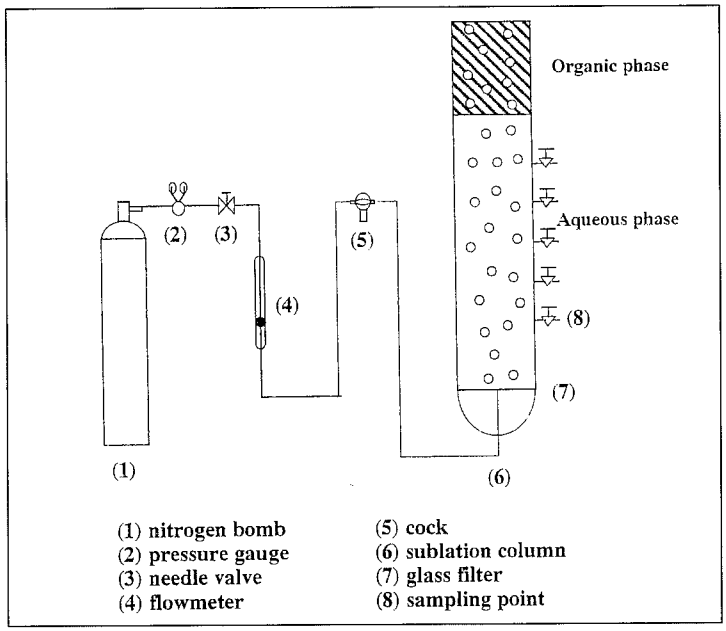
It was also clarified that the difference in the organic substance removal ratio is due to the difference in the surface activity, or due to the difference in the adsorption volume at the gas-liquid surface boundary. Adding salt to an aqueous phase causes the salting-out effect to increase the concentration of mono-chlorobenzene at the gas-liquid boundary surface and increase the mono-chlorobenzene removal ratio. Also, adding ethanol to an aqueous phase causes a reduction in the water phase surface tension resulting in a decrease in the diameter of bubbles, so that the surface area of the air bubbles per unit volume is increased. Therefore, adding a small amount of salt or ethanol into a water phase increases the mono-chlorobenzene removal ratio.



Effect of salts added in aqueous phase on removal percentage of MCB
conditon: MCB initial conc. = 200mg /dm³
phase ratio (A/O) = 20
gas flow rate = 0.67cm³/s
added salt conc. = 0.1mol/dm³

In both these cases, the water after treatment was clean enough to permit disposal without further treatment. The solvent used in the recovery process can subsequently be incinerated with kerosene. A distinct advantage of this new solvent sublation technology is that a large volume of organic substances can be removed at a low cost.

* ***Kansai University***
The Department of Chemical Engineering, Faculty of Engineering
3-3-35, Yamate-cho, Suita City, Osaka 564-8680
Tel: +81-6-368-0856
Fax: +81-6-388-8869



Schematic diagram of experimental apparatus of solvent sublation

98-08-008-04
Technique to Recycle Electric Converter Reducing Slag

The New Soil Improvement Material Development Research Society established jointly by Daido Steel Co., Ltd., Aichi Steel Works, Ltd., Daido Industrial University and other organizations has developed a technique to recycle electric converter reducing slag. The society directed its attention on the electric converter reducing slag characteristics which are similar to those of cement, tried to apply the slag as a ground stabilization material, and plans to commercialize the recycled reducing slag within about one or two years.

The converter reducing slag consists almost entirely of calcium oxide, with small amounts of silica and alumina, and when water is added to this mixture, the slag is converted into a substance that reacts with soil components and water.

Mixed dredged sand and electric converter reducing slag was used in sand embankment reinforcing experimental work in Nagoya Harbor. As a result, the experimental embankment constructed by using dredged sand containing 20% of converter reducing slag displayed a strength comparable to that of a structure constructed by adding 5% of cement.

This means that the strength of the dredged sand was increased by about 100 for times improvement of flimsy terrain for the construction of roads and residential housing foundations, allowing the commercialization of the slag. Iron & steel slag is recycled by almost 100%, but the recycling of converter reducing slag still remains very low. Therefore, this new technique commercialization will not only promote the recycling of converter reducing slag but also enable the effective utilization of flimsy terrain generated over large areas by dredging as an effective civil engineering resource.

* ***Daido Steel Co., Ltd.***
Technical Development Research Center
10, Ryugu-cho, Minato-ku, Nagoya City,
Aichi Pref. 455-0022
Tel: +81-52-691-5135
Fax: +81-52-691-5311

98-08-008-05

Technology for Complete Decomposition of Polychlorinated Biphenyls

Prof. N. Yamazaki and his research team of the Research Laboratory of Hydrothermal Chemistry, Faculty of Science, Kochi University, have established a technology to virtually completely decompose harmful substance polychlorinated biphenyls (PCB)s with high-pressure, high temperature alkali water at 300 °C and 10MPa (atmospheric pressure).

This new technology permits organic chloride-based chemical substances to be decomposed efficiently at a lower temperature and pressure than the existing supercritical water technology, and the cost is also lower.

Water has the characteristic of decomposing hydrogen and chlorine containing organic compounds, and the decomposition is accelerated at higher temperatures and pressures. PCBs are decomposed effectively by utilizing this characteristic. Specifically, a sodium hydroxide aqueous solution and methanol are mixed together and placed in a continuous treatment system, developed by the laboratory to decompose PCBs into chlorine and phenolic compounds. The chlorine combines with sodium hydroxide and is converted into saline water.

Technology for organic chlorine compound decomposition is being applied, that uses supercritical water maintained at over 374 °C and pressure of over 22MPa. The newly established technology operates at a lower temperature and pressure than supercritical water, so the smaller treatment system can be designed to lower the capital cost substantially.

* ***Kochi University***
Faculty of Science
2-5-1, Akebono-cho, Kochi City, Kouchi
Pref. 780-8520
Tel: +81-888-44-8350
Fax: +81-888-44-8362
E-mail: suinetsu@cc.kouchi-u.a.c.jp

98-08-008-06

Agglomeration Agent for Paint Recovery

Toho Engineering Co., Ltd. has started marketing a newly developed agglomeration agent TH Earth Clean 2100 that is effective for the recovery of paint sludge. The agent is sold at a domestic price of ¥ 1,200/kg.

This agglomeration agent uses no chemical substance, consists mainly of minerals and metallic ions existing in the natural world, and can rapidly separate the sludge circulated inside painting booths into water and paint. It is used at about 1% of the total volume of sludge to be treated, and is effective against a wide range of paints made of melamine, acrylic and urethane, and is usable for treating organic paints or aqueous paints.

By action of the natural minerals, the agent displays multiple decomposition and oxidation-agglomeration effects, the activated silicon retains these intense reactions and promotes organic decomposition, oxidation and carbonization, and reacts with the paints and organic substances existing in the waste water circulated inside painting booths to generate metal hydroxides. The colloidal particles of the formed metal hydroxides are enwrapped, precipitated, agglomerized and separated by chelate reaction and converted into a gelled state. These gelled particles are agglomerated, become larger, then form a sol, and eventually settle and accumulate.

The bacteria proliferating in paint sludge (and gas) are precipitated from the contaminated water, undergo agglomeration and separation, are chelated by the paint sludge and then settle and accumulate together with the paint sludge. The viscosity characteristic of paint sludge is decomposed into ultrafine particles by the basic reaction of TH Earth Clean 2100, and in the cirulation water containing the agent, a pseudo non-viscous effect is displayed. Therefore, the paint sludge adhesion onto the booth and along the circulation course as well as inside the pumps is decreased considerably to easen maintenance work as well as to reduce booth damage and problems.

The painting booth offensive odor is chelated by bacteria characteristic of paint sludge, so the generation of offensive odor is prevented by the pseudo deodoring effect, and the working environment is improved substantially. By removing the booth paint sludge with a solid-liquid separator, the circulation water can be utilized repeatedly over long periods of time, which translates into a substantial reduction of waste circulation water treatment cost.The distinct advantages provided by the agglomeration agent are that the paint booth characteristic offensive odor as well as putrefaction are eliminated, and that the recovery of agglomerates is easened considerably.

The water separated through the agglomeration agent addition can be reutilized as recirculation water, and the paint that has been coagulated and separated is converted into solid-state sludge with a centrifugal separator, to permit disposal as an industrial waste.

Compared with its treatment as a waste fluid, the treatment cost is less than one-tenth, so the total cost is reduced substantially. In addition, expert staff are unnecessary for carrying out these operations.

* ***Toho Engineering Co., Ltd.***
Public Relations Dept.
3-14-11, Shimizu, Kita-ku, Nagoya City,
Aichi Pref. 462-0844
Tel: +81-52-991-1040
Fax: +81-52-914-9822

Biotechnology & Medical Science

98-08-009-01
PTCA Dilatation Catheter

Telmo Corp. has marketed a dilation catheter Hayate that is used for percutaneous transluminal coronary angioplasty (PTCA) for treating myocardial infarction which occurs when the coronary arteries are contracted or clogged. The balloon at the tip of the catheter is made of a material featuring excellent elongation and contraction to enable the catheter to be used in a wide range of treatments. The catheter is sold at a domestic price of ¥276,000.

The new catheter is a semi-compliant type catheter since it is made of an advanced material and the balloon is not expanded excessively even when a strong pressure is applied. This characteristic lessens the burden on the blood vessels when dilating the stenosis. Therefore, the catheter can now be employed for a wide range of symptoms and treatments.

The balloon has a low-profile design and is coated hydrophilically, so it can cross smoothly through the stenosis.

The new catheter features a rapid exchange structure with the guide wire passed only through the tip part, which enables catheter changing easy when using one or two types of catheters in the PTCA procedure.

Dilation catheter Hayat

* ***Telmo Corporation***
Corporate Communication Dept.
2-44-1, Hatagaya, Shibuya-ku, Tokyo 151-0072
Tel: +81-3-3374-8266
Fax: +81-3-3374-8399

98-08-009-02
New Substance Promotes the Growth of *Bifidobacterium*

Toa Pharmaceutical Co., Ltd., and the Showa College of Pharmaceutical Sciences have jointly discovered a new substance 3,3-dihydroxyazetidine, which promotes the growth of bifidobacterium, a useful bacterium in the large intestine. This substance has the property of enhancing the growth of bifidobacterium when it is present only in a very small quantity. In the future, both research parties will study the use of this substance in health foods or as a growth promoter for bifidobacterium.

The conventional way of enhancing the growth of bifidobacterium is to provide oligosaccharides as a food source. This newly discovered substance to provides oligosaccharides as a food source, and enhances the rate of growth even at 40 picograms. This substance was discovered in a study examining why "BIO-THREE", a preparation of living bacteria marketed by Toa Pharamaceutical Co., Ltd., as a main product, exerts a growth increasing effect on bifidobacterium.

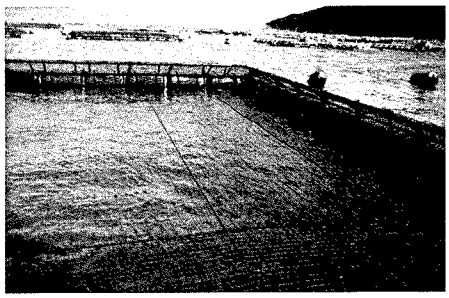
The strain of BIO-THREE is the amylolytic bacterium TO-A which belongs to the family of Bacillus subtilis that is isolated from fertile soil. The amylolytic bacterium TO-A , compared with Bacillus subtilis in general, displays a better saccharification capability of decomposing and converting starch into sugar such as grape sugar. It is a strain of bacteria generally known as potato bacteria, which has spores featuring excellent stability, acid resistance, salt resistance and chemical resistance, and the bacteria is used for manufacturing starch decomposition enzymes and various other types of decomposition enzymes.

* ***Toa Pharmaceutical Co., Ltd.***
Development Planning Dept.
2-1-11, Sasanotsuka, Shibuya-ku, Tokyo 151-0073
Tel : +81-3-3375-0511
Fax : +81-3-3375-0539

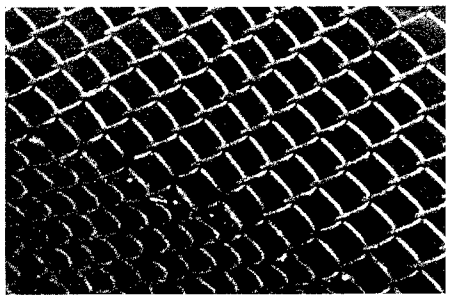
98-08-009-03
Copper Marine Cultivation Wire Netting Utilizes Copper Sterilization and Antibacterial Effects

Sambo Copper Alloy Co., Ltd. has started distributing samples of a newly developed copper marine cultivation wire netting that utilizes copper sterilization and antibacterial effects.

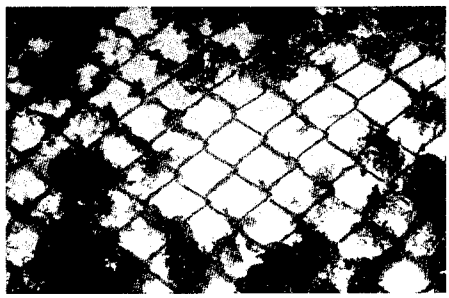
This UR 30 Wire Netting is made of a copper alloy consisting of copper, zinc and stannic nickel, which when immersed in seawater generates a weak concentration of copper ions which feature the effect of suppressing microorganism and algae growth. The conventional types of marine cultivation wire nettings made of chemical fibers or galvanized iron wires are easily adhered with algae and shells in about one month, deteriorating sea current passage and resulting in improper growth of cultured fishes and the generation of patho-



UR 30 test fish preserve



UR 30 after 1 year of use



Ordinary wire after 1 year of use

logical bacteria inside culturing ponds. Therefore, the wire nettings have to be washed frequently and the algae and shells removed using chemicals, which requires to huge costs and much labor in the maintenance of fish cultivation ponds.

The UR 30 wire netting prevents the adhesion of algae and shells on the netting surface and enables cultivation ponds to be maintained in sanitary condition at a low cost. In addition, there is also the effect of preventing parasitic worms and pathological bacteria from attacking the cultured fishes, so it is the ideal wire netting that resolves various problems associated with cultivation ponds using conventional types of wire nettings.

A durability test over a period of five years was completed at Kinki University Marine Research Laboratory, which corroborated that the copper wire netting undergoes a wire thickness decrement of only 0.01 mm/yr in seawater, or that it features a service life expectancy that is double compared with those made of chemical fibers or galvanized iron wires.

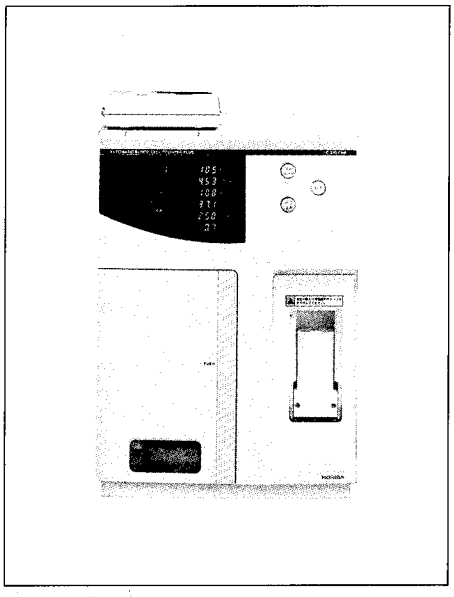
Marine cultivation pondage wire netting (12 × 12 × 10 m size) costs about ¥1.5 million in Japan, and the cost is about doubled by using a wire netting made of copper, but this UR 30 wire netting has a longer service life and lower maintenance cost, so there is the advantage that the total cost is decreased and the waste netting can be recycled safely.

* ***Sambo Copper Alloy Co., Ltd.***
Public Relations Dept.
8-374, Sambo-cho, Sakai City, Osaka 590-0906
Tel: +81-722-33-1611
Fax: +81-722-27-6590

98-08-009-04

Compact Blood Component Analyzer to Diagnose Inflammation

Horiba Ltd. has developed the world's first compact blood component analyzer which can measure the eight essential items for blood component testing, including white and red blood cell counts, as well as CRP (C-reactive protein), and will be very useful in diagnosing inflammation. The analyzer provides inflammatory marker item testing, concurrently measuring CRP and white blood cell count, for diagnosing inflammation, including infection. These measurements



Compact blood component analyzer

can be made in just 260 seconds, about one-fifth the time with conventional equipment for bloodcell count. Indicators for the examination include erythrocyte sedimentation rate (ESR), white blood cell count (WBC), acute phase protein composition (such as CRP), fractionation of serum protein, etc. In cases of inflammation, especially infection, CRP levels will first increase for one or two days after the onset of a viral or other infection. Then the WBC will increase as the infection progresses. The infection is progressing if an increase in CRP level is followed by an increase in the WBC. If the CRP level increases and then the WBC drops to normal, the condition has subsided . For early diagnosis of infection, WBC and CRP should both measured from the same blood sample.

This new analyzer is compact (300 × 410 × 100 mm) and lightweight (18kg). Only one blood sample is required, and the amount required is only 0.18 milliliter of whole blood. It will be especially useful to medical practitioners, particularly pediatricians, who need test results before writing a prescription. The analyzer will be sold and distributed by Fukuda Denshi Co. in Japan and mainly by ABX Corporation for oversea markets.

* ***Horiba Ltd.***
Public Relations Dept.
2, Miyanohigashi-machi, Kishoin, Minami-ku, Kyoto City, Kyoto 601-8510
Tel : +81-75-313-8121
Fax : +81-75-321-6621

98-08-009-05

Detection of Leakages in Artificial Dialysis System Hollow Thread Dialyzers

M.E.C. Co., Ltd. has developed and started marketing a new type of system for detecting weak leakages occurring in the hollow threads dialyzers of artificial dialysis systems. The flow rate system is adopted to measure the leakage volume, so the system features an accuracy that is more than a hundred times greater than the generally adopted differential pressure type inspection system. Incidentally, this is the world's first time that a flow rate type inspection system has been developed and applied to artificial dialysis systems. The artificial dialyzer consists of about 10,000 superfine hollow threads each with a diameter of about 230 μm, and the dialysis fluid is passed on the outer side of these hollow threads. Waste matter is effused on the outside of the dialysis fluid to purify the blood when passed through these hollow threads. Whenever there is damage to these hollow threads, dialysis cannot be performed properly, and precision examination will become necessary.

The newly developed system sends air into the hollow threads to retain a fixed pressure inside the hollow threads, and the degree of leakage is derived from the volume of air that has to be supplemented. For pressure generation, the system incorporates a sensor called electropneumatic regulator that controls the pressure to about 0.6 kg/cm^2. The minimum accuracy for flow rate readout is 0.01 cc/min, a hundred times more accurate than the accuracy of 0.1 mm H_2O of the conventional type of differential pressure type inspection system. The time necessary for inspecting one specimen is only about 20 s.

With the conventional type of system, the general method is to detect leakages from the degree of pressure decrease of the air fed into the hollow threads. To increase the accuracy, inspection had to be performed at high pressure. The new system enables examination at a low pressure, which decreases the error arising from the surrounding temperature changes or the deformation of the hollow threads when a pressure is impressed, and the examination accuracy is improved substantially.

The new system performs examination within the pressure of 0.6-1 kgf/cm^2. Its size is 172.5 × 300 × 273 (H) mm and weighs about 10 kg.

* *M.E.C. Co., Ltd.*
Public Relations Dept.
42-18-901, 3 Chome, Shimorenjaku,
Mitaka City, Tokyo 181-0013
Fax: +81-422-42-1100

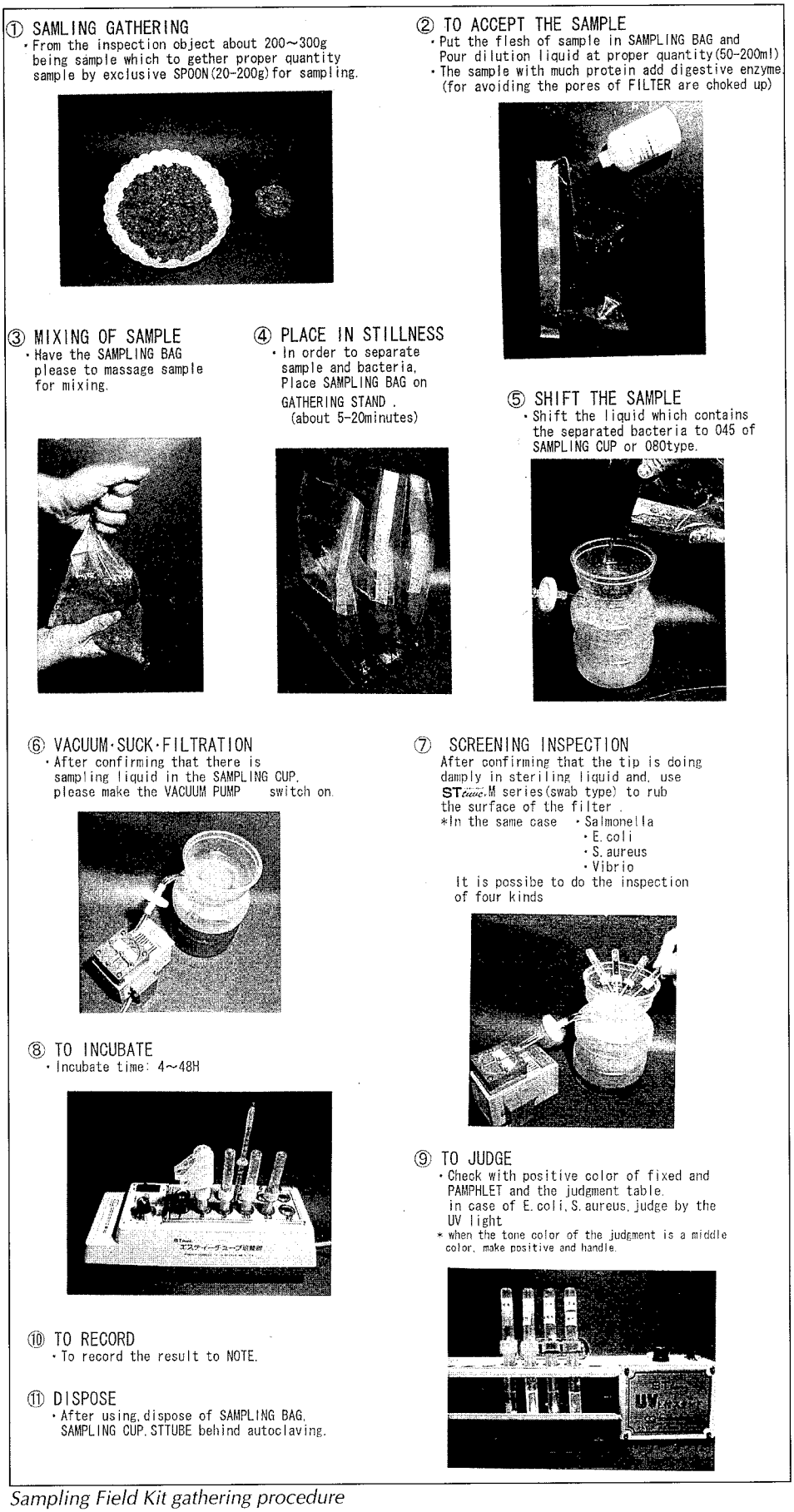
98-08-009-06

Simplified Type Inspection Apparatus for Detecting Microbes

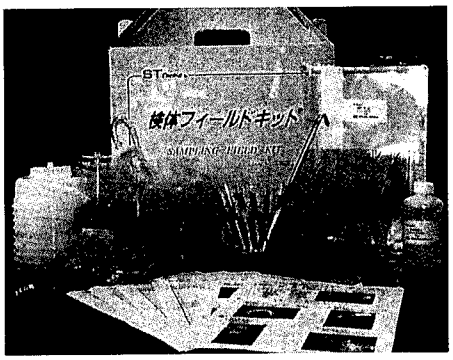
Corona Giken Industry Corp. has developed a simplified type inspection apparatus Sampling Field Kit that features a simplified construction and enables microorganisms such as salmonella bacteria to be detected rapidly. Due to its development, it is now possible to test specimentes of microorganisms as small as 1-15 μ in about thirty minutes, which used to require 3-4 days previously. The apparatus including all accessory parts is sold at a domestic price of ¥ 75,000.

The Sampling Field Kit, used in combination with an ST tube, will display even greater detection capability. Microbes exist on the surface of the filter after adsorption and filtration, so by combining several ST tubes together, it will be possible to improve the detection efficiency. Due to the filtration residue subsequent to material dilution, even if only a few bacteria are present on the filter, these bacteria can be detected by action of the great sensitivity of the ST tube. The ST tube consists of a sealed liquid state culturing bed cotton-tipped bar for bacteria collection and a disk containing ancillary drugs.

The liquid state culturing bed consists of a bacteria nutrient, a pH value indicator and mannitol. When the number of bacteria increases, sugar decomposition starts and the acidity indication will bring about a change in the pH value indicator color. Also, the disk incorporates a bacteria proliferation suppression agent and an antimold drug which provides the culturing bed selectivity of microbes. For example , in case of meat inspection , taking a specimen of about 300g, about 25 g of sample is extracted from the specimen, diluted with a dilution agent, and the specimen and microorganisms separated.



Sampling Field Kit gathering procedure



Sampling Field Kit

The existence of microorganisms is judged after microorganism culturing by using a incubator and by observing the color changes occurring in the culture bed.

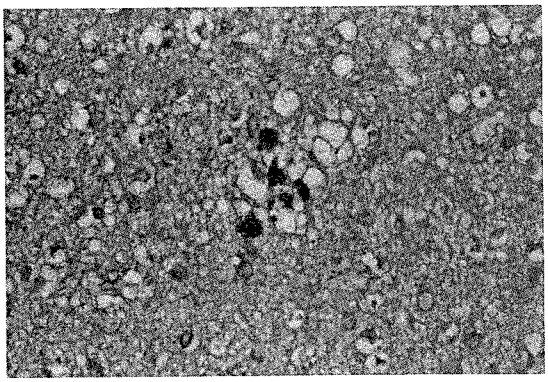
Normally, 3-4 days are required for salmonella bacteria inspection, including bacteria culturing and separation, but applying this new system enables the bacteria to be inoculated on the ST tube as rapidly as in a single day, and the screening results can be known the following day.

Applying the new system enables screening inspections to be conducted, from specimen preparation to acquisition of results, in connection with all typical food poisoning bacteria including salmonella bacteria, E. coli, staphylococcus and intestinal inflammation Viblio bacterium. The running cost is low at about ¥ 700 per specimen. In addition, unlike formal inspection methods, there is no need for an expert when using the system, and even a novice can perform these inspections.

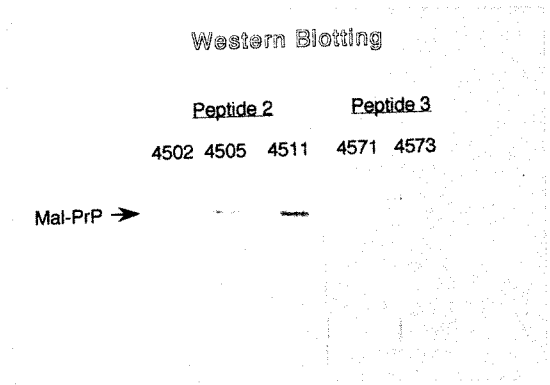
* ***Corona Giken Industry Corporation***
2033-11, Matsudo, Matsudo City, Chiba Pref. 271-0092
Tel: +81-47-367-5656
Fax: +81-47-367-8955

98-08-009-07
Detection of Prion Protein Associated with Creutzfeld-Jakob Disease

Prof. Y. Mizushima and Assoc. Prof. M. Higaki of the St. Mariana Medical University have established a new technology to detect prion protein that is associated deeply with the incurable Creutzfeld-Jakob disease. An antibody that binds readily with a portion of the amino acids comprising the prion protein is used, allowing selective detection of the prion protein from among the various proteins in a mixture in biological tissues. It is as yet impossible to discriminate abnormal prion protein that is the cause of Creutzfeld-Jakob disease, but the research team anticipates that the new technology would promote the development of methods for the early discovery and effective treatment of the disease.



CJD patient immunity staining



Western blotting

The prion protein consists of 239 different amino acids, and the newly developed technology produces the antibody that binds selectively with a portion of these amino acids to promote the detection of the prion protein. It is known that the scrapie prion protein has three places in which the conformation is different from normal prion proteins, and the newly developed antibody can recognize one of these three amino acid sequences places.

The research team planned to develop specific and sensitive monoclonal antibodies and single-chain variable fragment (ScFv) proteins against synthetic peptides derived from the human prion protein to detect the prion protein from the clinical samples of affected patients. Two peptides were synthesized with sequences corresponding with those of the amino acid sequences (A) 96-114 and (B) 214-232 of human prion protein.

Five week-old female Balbe/c mice were immunized with these peptides conjugated with KLH together with Freund complete adjuvant and boostered with peptides and incomplete adjuvants.

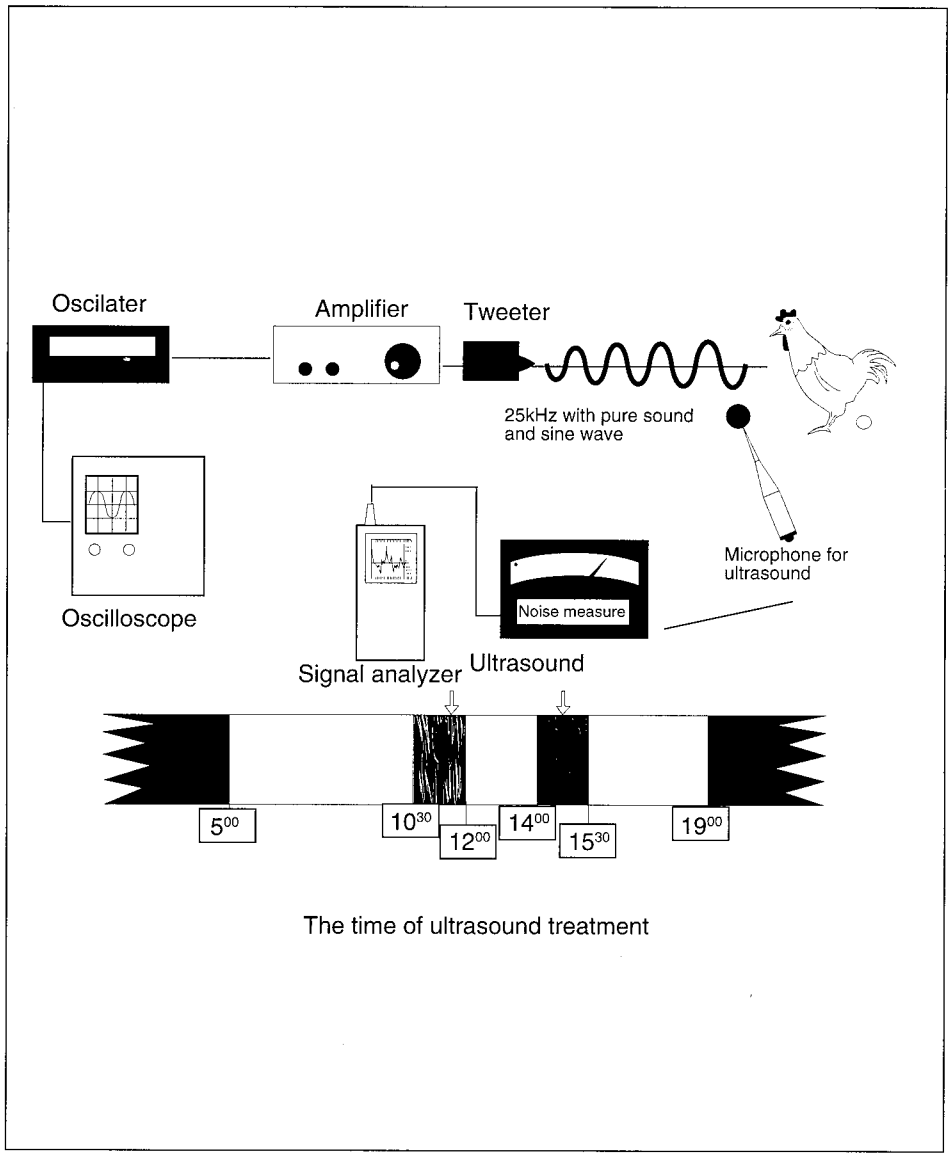
The elevation of specific antibody against these peptides in the sera was measured using ELISA. Then spleen cells were prepared after intravenous injection with these peptides. To obtain hybridomas producing monoclonal antibodies, these spleen cells were fused with a PAI myeloma cell line by the PEG method and HAT selection was performed.

For the phage library method to obtain ScFv, mRNA was purified from spleen cells and first-strand cDNA was amplified by PCR using primers of variable regions of heavy or light chains. After assembly of VH and VL, ScFv was ligated into the pCANTAB 5E vector and transformed into E. coli. Then antibody production was examined by ELISA.

The research team obtained six hybridomas producing MAbs that reacted with peptide A and three hybridomas reacting with peptide B. Furthermore, 7 MAbs reacted with recombinant PrP by Western blotting. And one MAb (2-7H) reacted with brain extracts of a CJD patient and stained Kuru plaques immunohisto-chemically. These results indicate that Mab (2-7H) is useful for the detection of prion protein.

Creutzfeld-Jakob disease causes acute dementia. The prion proteins inside the nerve cells assume an abnormal shape for some indefinite reason, and this state progresses to eventually kill the nerve cells and cause dementia. In the process of the abnormality, a change is brought about in the relative positions of the three unique amino acid sequences of the prion protein, so it will become possible to diagnose this disease if an antibody was developed that can recognize these three sequences simultaneously. At present, more than a year is required for mice to be injected directly with blood agents to cause a disease. If it becomes possible to advance diagnosis using an antibody, the diagnosis can be shortened to several hours.

* ***St. Mariana Medical University***
Institute of Medical Science
2-16-1, Sugao, Miyamae-ku, Kawasaki City, Kanagawa Pref. 216-8511
Tel: +81-44-977-8111
Fax: + 81-44-977-2696



Materials and methods

98-08-009-08

Promotion of Chicken Maturation by Ultrasonic Wave Irradiation

The Wakayama Prefectural Poultry Experiment Station has succeeded in accelerating chickens first egg-laying through ultrasonic wave irradiation. It was possible to promote chicken maturation to be quicken the first egg-laying time about one week compared with ordinary chicken by irradiating with ultrasonic wave of 25,000 Hz. The experiment station observes that the new technology will contribute to breed improvement and to chicken culturing efficiency improvement, and plans to conduct follow-up survey on the breading season of the irradiated chickens.

The research study was conducted to investigate the effects of ultrasonic waves on precocious sexual maturity of white leghorn pullets. The fowls were divided into two groups when they were 70 days old and reared in individual cages under 14hrs lighting and 10 hrs darkness. One group was exposed to ultrasonic waves for 3 hrs/day from the 93rd day, and the other group served as a control group. The age at the onset of egg laying and the subsequent performances of these chickens were compared afterward. The age when 50% of individuals laid first egg was 136 days in the ultrasound group and 144 days in the control group.

The age of 50% egg-laying in each group was 141 days and 145 days, respectively. The egg production rate during the next two weeks was 4% higher in the ultrasonic wave irradiated group compared with the control group. Throughout the experiment, plasma progesterone (P_4) and estradiol (E_2) concentrations were measured by enzyme immunoassay (EIA). The plasma P_4 level elevated around the day of first egg-laying, while E_2 increased 2-3 weeks before the first lay. The changing patterns of these hormone levels, however, resembled each other in both the ultrasonic wave irradiated and control groups. These results indicate that ultrasonic wave effectively induces precocious sexual maturity in chickens.

* ***The Wakayama Prefectural Poultry Experiment Station***
1090-1, Funatsu, Nakatsu-mura, Hidaka-gun, Wakayama Pref. 644-1111
Tel: +81-738-54-0144
Fax: +81-738-54-0966

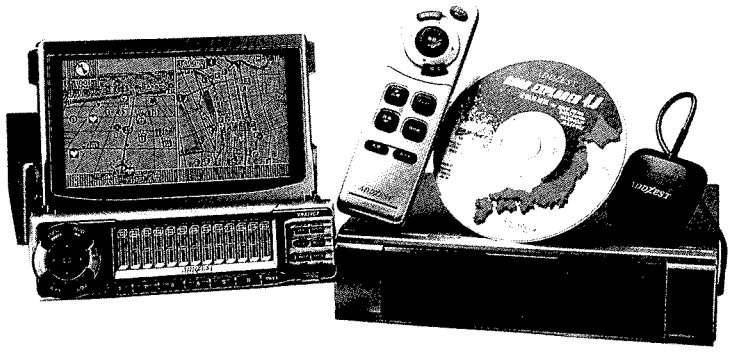
F L A S H

Voice Unit Recognizes World's Largest Number of 200,000 Words

CLARION Co., Ltd. has placed on the market seven new models which are additions to its existing family of the ADDZEST Z Series:

The IDIN Center Control Unit, Interactive Navigation System, 2 DIN Center Control Unit, TEL-LINK unit, Voice Control Unit and two models of CD/CD-ROM Changers.

The AV Amp with CD/MD/DSP/EQ/TEL-LINK/NAVI Control TV/AM/FM Tuner (Model VRX740Z, standard price ¥ 178,000) is a center control unit incorporating a 5.8-in LCD monitor in the IDIN size body, and when used in navigation by linking together with the Interactive Navigation System placed on the market at the same time (Model NAX940ZF, standard price ¥ 163,000) and incorporating the VICS FM Multiplex/Voice Synthesizer, performs navigation display with an LCD monitor and audio display with a front panel. Also, by incorporating a Turn by Turn function, it is possible to show the distance and turning direction with ease up to an intersection by voice and arrows. In addition, it incorporates functions for readup of character information as on VICS level 1, also the T.T.S. (text to speech) function for offering information by voice, or information relating to the road conditions which change from moment to moment without having to look at the display.



ADDZEST Z Series : AV Amp with CD/MD/DSP/EQ/TEL-LINK/ NAVI Control TV/AM/FM Tuner : VRX740Z

The double DIN size Hybrid Navigation System (Model MAX 440Z, standard price ¥ 288,000) with built-in CD/MD/TEL-LINK Control and TV/AM/FM Tuner is an ultimate type center control unit incorporating a 5.8-in LCD monitor, navigation unit, AM/FM/TV tuner and CD/MD deck amp in a 2 DIN size assembly.

The Voice Control Unit (Model RVH440Z, standard price ¥ 52,500) features the recognition of the maximum number of about 200,000 words, users are not limited, and is applicable to non-specified speakers. Used in linkage with the Interactive Navigation System NAX 940ZF marketed this time, its main operations can be performed in the manner of conversation with the character Naviko. The voice is input in conformance with the display instructions, so there is no need for remembering all the manipulation words. For example, if the user says, "I'm hungry", the system replies, "Then let's go to eat something", and starts looking up restaurants. And when the user says "Let's go home", the system replies, "I'll compute the road back to your home", and starts navigating the homing course.

The TEL-LINK unit (Model JCH540Z, standard price ¥ 27,200) with audio control function is connected to portable telephones to perform hand-free communications. When calling by telephone, the partner name and telephone number registered in the portable telephone memory is read out with the built-in T.T.S. function, and communications is commenced by pressing the SEND/FUNC key denoting the suitable destination. When the telephone is connected, a state of communications is assumed immediately with the automatic message arrival ON state, so there is no need to take up the telephone set, and safe driving is possible.

Also, the Z Series CD/CD-ROM changers are available as the 12 Disk CD/CD-ROM Changer (Model CDR1240Z, standard price ¥ 42,000) and the 6 Disk CD/CD-ROM Changer (Model CDR640Z, standard price ¥ 36,800).

* ***Clarion Co., Ltd.***
Public Relations Div.
2-22-3, Shibuya, Shibuya-ku, Tokyo 150-8335
Tel: +81-3-3400-1121
Fax: +81-3-3400-8505

JETRO

Japan External Trade Organization

Industry and Technology Department